EXPANDED SITE INVESTIGATION

REMEDIAL OVERSIGHT OF ACTIVITIES AT FORT DEVENS PLOW SHOP POND AND GROVE POND

FINAL

May 2006

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Region 1
Boston, Massachusetts

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GROVE POND AND PLOW SHOP POND
AYER, MASSACHUSETTS

May 2006

Prepared for :

USEPA Region 1
Contract EP-W-05-020 Task Order #01

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) directed Gannett Fleming, Inc. (Gannett Fleming) to conduct an Expanded Site Investigation (ESI) and prepare an ESI Report for Plow Shop and Grove Ponds that are adjacent to the former Fort Devens National Priorities List (NPL) site. The objective of this investigation is to prepare an ESI report, using the sediment, soils, surface water, biota, benthic invertebrates, fish, frog tissue, swallow tissue, and toxicity data collected to date, to support the selection of an approach for site remediation. This report is in response to the approved Task Order Number #01 under Contract Number EP-W-05-020.

The former Fort Devens is located at the intersection of four towns: Ayer, Harvard, Lancaster, and Shirley in Middlesex and Worcester counties, Massachusetts. It is located 40 miles west of Boston. Fort Devens was listed on the NPL in November of 1989. In 1991, it was identified for cessation of operations, pursuant to the Base Realignment and Closure of 1991, commonly known as BRAC II and was officially closed in September 1996. Portions of the property formerly occupied by Fort Devens were retained by the Army for reserve forces training and renamed the Devens Reserve Forces Training Area (RFTA). Areas not retained as part of the Devens RFTA were, or are in the process of being, transferred to new owners for reuse and redevelopment.

Plow Shop and Grove Ponds are located at the southern border of the business and residential district in Ayer. The pond basins are bounded on the west and south by former Fort Devens property, to the northeast by residential areas, and to the southeast by land controlled by the Town of Ayer and used as a municipal well field. They are the fifth and sixth in a chain of six ponds in Ayer.

Sediment data collected from the two ponds through the 1990s indicate that elevated levels of several trace elements including arsenic, cadmium, chromium, mercury, and lead may be present at concentrations that pose significant human health and ecological risks. In October 1995, the Army issued a report that summarized all of the information collected to date and performed a Preliminary Risk Evaluation (PRE) in order to qualitatively gauge what risk the ponds were posing to human health and the environment. Primary concerns focused on the impacts from the ponds on Town and Devens drinking water supplies, fish and wildlife resources, and recreational activities such as fishing, hunting, and swimming. The PRE determined that exposure to both Plow Shop and Grove Pond sediments presented both human health and ecological risks. Both ponds were subsequently posted "Catch and Release Fishing Only."

In the late 1990s, EPA, in cooperation with the U.S. Fish and Wildlife, the U.S. Geological Service and the MADEP, embarked upon an effort to collect the necessary information to address the data gaps identified in the Army's 1995 report. The data collected from the joint effort were used when preparing this ESI Report for both Grove and Plow Shop Ponds.

1.1 Report Organization

This report consists of eight sections. In Section 1.0, the Introduction defines the purpose and study objectives of the ESI. Section 2.0 provides a general description of Grove Pond and Plow Shop Pond, including site history and background information. Within Section 3.0 is an evaluation of the existing data and includes references to previous studies and investigations; a summary of the analytical data is presented; and background studies are identified. In Section 4.0, a brief description of the physical characteristics of the study area is provided including the local geology, local meteorological conditions, and a general description of the surface water and groundwater hydrology. Section 5.0, presents conceptual models and supporting information for the presence of the principal chemicals of potential concern in sediment in Grove and Plow Shop Ponds. This section includes a discussion of the rationale for the concentration, distribution, plausible source(s), and transport mechanism(s) for each element of interest. The emphasis of this section is on elements and/or compounds that have been identified in previous studies of the ponds or in the present effort as potentially significant from a risk perspective. In Section 6.0 is the Human Health Risk Assessment, which evaluates whether site contaminants pose a current or potential risk to human health and the environment. In Section 7.0 is the Ecological Risk Assessment, which evaluates and assesses the risk to the environment posed by site contaminants. Lastly, Section 8.0 provides a summary of the conclusions.

2.0 SITE BACKGROUND

For the Grove and Plow Shop Ponds ESI, the "study area" or "the site" refers to Grove Pond and Plow Shop Pond, located in the Town of Ayer, Middlesex County, Massachusetts. Refer to Figure 2-1 – Site Location Map for the approximate boundaries of the ponds. The study area is located approximately 35 miles northwest of Boston.

2.1 Site Description

The study area is located northeast of the former Fort Devens, currently referred to as Devens. Grove and Plow Shop Ponds are included in a string of six ponds. Grove and Plow Shop Ponds are the most downgradient of the six ponds and, Plow Shop Pond drains into Nonacoicus Brook. In the downgradient direction, the string of ponds are referred to as: Long Pond, Sandy Pond, Flannagan Pond, Balch Pond, Grove Pond, and Plow Shop Pond. These ponds were formed by a series of dams installed in the 19^{th} century. During that time Grove and Plow Shop Ponds were periodically "flowed" or flooded during the winter months to provide a source of ice and were drained during the spring and summer for grazing of livestock. Prior to the existence of the ponds, the area that is now submerged was occupied by meadows underlain by peat bogs.

Grove Pond is roughly triangular in shape and covers about 60 acres. The northern shore includes the location of the Plastic Distributing Company (PDC, location of former tannery operations), Pirone Park owned by the Town of Ayer, and residential properties. The southeastern shore is bordered by property owned by the Town of Ayer. The southern shore is also bordered by property owned by Fort Devens. Within this area are Devens' water supply wells, which are currently active with treatment**.** Immediately beyond the Devens' shoreline is the Massachusetts National Guard. The western edge of the pond is formed by the railroad causeway, owned and operated by Guildford Transportation (formerly Boston & Maine Railroad, B&MRR).

Grove Pond is shallow, with maximum water depth approximately 5 to 6 feet, and the water is frequently eutrophic, or well nourished by aquatic plant life. The pond bottom consists largely of a thick mat of decomposing vegetation. Grove Pond receives drainage from Balch Pond, as well as from Cold Spring Brook and Bowers Brook, and discharges through a culvert on the western edge of the pond into Plow Shop Pond. Cold Spring Brook is downgradient of Devens. Bowers Brook connects into Cold Spring.

Town of Ayer Well Field: The Town of Ayer wells are located on south shore of Grove Pond off Barnum Road, immediately outside the Devens Barnum Gate. These two wells were installed several decades ago by the Town of Ayer originally as backup to the Town's Spectacle Pond well field. The first of these wells, Grove Pond No. 1, was installed in 1943. It is 60 ft deep, with a rated capacity of 694 gpm. The second, Grove Pond No. 2, was constructed in 1952. It is 60.5 ft deep, with a rated capacity 780 gpm, and is located 120 ft west of the first well. Both are within

150 ft of Grove Pond. The original, hand-sketched construction diagrams for these wells, as well as the drillers' log for Grove Pond No. 2, are reproduced in Appendix A of the 1999 Phase I Interim Data Report (Gannett Fleming, 1999). In 1998, after rehabbing and construction of a water treatment plant at the site, these wells were added to Town of Ayer's distribution system.

Devens Grove Pond Well Field: The Devens Grove Pond well field is located approximately 1,000 feet to the west of the Town of Ayer wells. The general hydrogeologic setting of this well field is similar to the Town of Ayer wells, i.e., the wells are screened in the overburden aquifer in proximity to Grove Pond. These 12 wells have 8-inch diameter casings and 10 ft screens centered at depths of 35 ft to 43 ft below ground surface (bgs). The wells have been pumped at relatively low rates since activities on the Base decreased in recent years (e.g., 550--680 gpm total production for several days per month, in 1998).

Plow Shop Pond is also a shallow pond and is approximately 30 acres. The central portion of the pond is approximately 8 feet deep, and the deepest portion of the pond is reported to be at the northeast arm of the pond. The water level is controlled by a dam located at the northwest corner of the pond where it forms Nonacoicus Brook and its associated wetlands, which in turn flows approximately 1.5 miles northwest into the Nashua River. Plow Shop Pond is similar to Grove Pond in regards to the aquatic community; however, Plow Shop Pond is smaller and slightly deeper, and the aquatic vegetation tends to be less dense than Grove Pond. (USFWS, September 2000)

The northern shore of Plow Shop Pond is bordered by commercial businesses. The eastern shore is the Guilford Transportation railroad causeway. The southern and western shores include the former railroad roundhouse, and woodland and grassland associated with Shepley's Hill Landfill. Both ponds are used by local residents for recreational fishing. Signs are posted for "catch and release" fishing.

In 1998, the U.S. Geological Survey (USGS) used a high-frequency acoustic energy fathometer and ground-penetrating radar (GPR) to measure water depth and saturated sediment thickness at more than 1000 locations in Grove Pond and Plow Shop Pond (Mercadante et al., 1999). Ground-truth values were obtained manually at several locations by pushing a stick into the sediment until refusal was met. Results from Grove Pond show a maximum water depth of 1.93 meters, in the northwest end of the pond. Sediment thickness is generally uniform over much of the pond bottom, ranging from 0.5 m around the pond's perimeter to about 2.5 m in spots along the pond's central axis. In Plow Shop Pond, the maximum water depth, 2.43 m, occurs at the north end of the northeast arm of the pond. Sediments in Plow Shop Pond are thicker than in Grove Pond. Sediment thickness over most of the western half of the pond is approximately 5 to 5.5 m in places and may have been emplaced prior to the construction of the dam in 1887 (Mercadante et al., 1999). On the eastern side of Plow Shop Pond, sediment thickness is somewhat more uniform, ranging from 0.5 m along the shore to about 4 m at a distance of approximately 100 m offshore (toward the center of the pond).

2.2 Site History

Gannett Fleming reviewed an aerial photograph from 2001, Sanborn Maps for the years 1892, 1921 and 1949, and various reports to understand the general history of the ponds and land uses adjacent to the ponds and brook in regards to potential sources of contaminants to the study area. Refer to Appendix A for the Sanborn Map Review, which includes property descriptions from 1892 to 1949.

Grove Pond

A tannery, located on the northwest corner of Grove Pond, operated intermittently from 1854 through June 1961 until a fire destroyed the operation. Prior to 1953, tannery wastes were discharged directly into Grove Pond with little or no treatment. In addition to tannery operations, a landfill was formerly located between the tannery and Grove Pond. Its location is suggested by aerial photographs that show gradual infilling of a cove in the northwest corner of Grove Pond.

According to the Sanborn Map Review, north of the tannery is the location of a former foundry and machine shop. These types of operations are documented as early as 1887, and operations ceased some time between 1921 and 1949. The 1949 Sanborn Map indicated that the property was used by a rope storage company and for paper and pulp storage. This area is the current location of the Faulkner Drive site as shown on Figure 2 –1 Site Location Map.

East of the former tannery, is Pirone Park, where landfilling may have occurred in the past. According to the Environmental FirstSearch™ database for the study area, a solid waste landfill is present at Pirone Park and is identified as the Town of Ayer Demolition Landfill. Refer to Appendix C of the May 2002 Gannett Fleming Data Gap Evaluation Report (Gannett Fleming, 2002a) for the results of the database search. Based on electronic correspondence with the MADEP, this "location was never a sited landfill, but is a piece of municipally owned property adjacent to Pirone Park. The Ayer DPW used the property as a dumping ground for pieces of asphalt and concrete, etc."…"It's badly overgrown with odd piles of asphalt and concrete the above interspersed among heavy vegetation. This site was never a municipal solid waste landfill nor a demo landfill."

Other potential sources of contamination to the pond are: stormwater runoff from the Guildford Transportation (former B&MRR) railroad yard and causeway on the southern/western shore; historical infilling of portions of the pond's perimeter; inflow from Cold Spring Brook and Balch Pond; and runoff from Devens and the Town of Ayer. Extensive apple orchards lie within the drainage basin for the pond, and historical application of arsenic-containing pesticides was suggested as a potential contaminant source. The contribution of arsenic and other metals to pond-bottom sediments by discharging groundwater may be significant.

Plow Shop Pond

Plow Shop Pond is bordered to the north by commercial properties. Sanborn records indicate that a lumber company, northwest of the pond, had been in operation since 1887 and at least until 1949.

Other potential sources of contamination to the pond are: stormwater runoff from the Guildford Transportation (former B&MRR) railroad and the former Railroad Roundhouse; historical infilling of portions of the pond's perimeter; and, Shepley's Hill Landfill.

Elevated concentrations of arsenic (greater than the current MCL of 10 µg/L) have been reported from groundwater in the vicinity of Grove Pond (Gannett Fleming, 2002) and Plow Shop Pond (e.g., from numerous monitoring wells and direct-push sampling in the vicinity of Shepley's Hill Landfill). While groundwater was not included in the list of media to be evaluated for this report, mechanisms responsible for trace-element mobilization have been described qualitatively in discussions of the Conceptual Site Models (CSM) as appropriate. For example, in Sec. 5.3.3 the CSM proposed for arsenic suggests that this element may be accumulating in pond sediments due to precipitation at a redox boundary below the sediment-water interface. Reducing groundwater, enriched in dissolved arsenic, iron, and other trace metals, migrates upward and encounters more oxidizing conditions before discharging to the pond. As geochemical conditions evolve along this flow path, to a point where pH and ORP favor oxidation of iron its precipitation as a solid, ferric oxyhydroxide. Other trace elements, including arsenic, are sorbed by this phase.

A detailed discussion of groundwater hydrologic conditions for Grove Pond and Plow Shop Pond is provided in Section 5.10. In this discussion, mass flux calculations are presented for arsenic, iron, and manganese in sediments in Red Cove. The agreement between the mass estimated from groundwater data for these elements, and the observed average sediment concentrations, supports the general CSM.

3.0 EVALUATION OF EXISTING DATA

3.1 Previous Studies

Gannett Fleming acquired documents pertaining to investigations of the study area and surrounding properties from several sources. The majority of the reports were received from the BRAC library located at Devens. Other sources to obtaining studies included the MADEP Central Regional office and the Town of Ayer public library. A large number of documents were acquired and are maintained in the Gannett Fleming library in Newton, Massachusetts. A listing of the documents from which data were taken for use in the ESI with brief descriptions is included in Appendix A. Following this list are key data tables used in this ESI Report.

As part of the Data Gap Evaluation prior to this ESI, Gannett Fleming summarized each document, describing the different investigations and analyses performed. The summaries indicated if laboratory reports or quality assurance/quality control (QA/QC) information was included in the document. These summaries were used to assist in determining which analytical data to enter into the Geographical Information System (GIS) database.

3.2 Summary of Analytical Data

Analytical data from nearly half of the reports obtained were used in the GIS database. The reasoning for not utilizing reports for data input was:

- The report did not include analytical data.
- More recent studies included the data from previous studies.
- The sample locations were unknown.
- Some reports were draft reports and finalized report information was used.
- Remediation activities took place and confirmatory samples indicated a change in contaminant levels.

3.2.1 Development of Database Management System

Gannett Fleming utilized GISKey™ software as the database management system for the analytical data used in this ESI Report. The GISKey database interfaces with AutoCAD®, where figures have been produced to aid in visually understanding and evaluating contaminant distribution. Sample locations are identified in Figure 3-1 and Figure 3-2 for Grove Pond and Plow Shop Pond, respectively. All contaminant information on the figures is included in the analytical summary tables. The analytical summary tables are organized by pond, medium, and depth and are included as Appendix B.

3.2.2 Analytical Data

As part of the Data Gap Evaluation, the chemistry data were compared to EPA Region 9 Preliminary Remediation Goals (PRGs) for the human health risk screening. For the ecological risk screening, analytical data were compared to US EPA National Ambient Water Quality Critera, Oak Ridge National Laboratory (ORNL) Secondary Chronic Values, Ontario Ministry of the Environment (OME) benchmarks, and National Oceanic and Atmospheric Administration (NOAA) standards, where applicable. These benchmarks were employed to add a risk perspective to an initial evaluation of the nature and extent of contamination in the ponds.

The majority of the reports used for database input did not include laboratory analytical reports. Where analytical reports were not available, summary tables found within the reports were used. In some cases, it appears that contaminant concentrations from summary tables may represent laboratory method detection limits; however, if there were no notes in the summary tables indicating detection limits, the concentration was entered into the database.

Most of the investigations focused on inorganics, which is appropriate for the historical and current site use around the ponds. However, in some cases, such as the Railroad Roundhouse, the emphasis included organics appropriate for the likely source of contamination.

Below is a summary of the environmental media reviewed for this ESI Report. Based on field observations (odors, sheen, *etc.*) recorded during EPA's 2004-2005 field programs, VOCs, SVOCs, and PAHs should be evaluated in the subsurface sediments and groundwater in the Red Cove and RRRH areas.

Sediment, < 1 foot below grade

For inorganics, primarily aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, sodium and zinc were in exceedance of the benchmarks identified above. In very few cases, all inorganics analyzed exceed the benchmarks. Pesticide analysis primarily included 4,4'-DDD, 4,4'-DDE and 4,4'-DDT and/or endrin with the exception of sediment samples SED-A through SED-G (October 1992), Sediment 1 through Sediment 6 (April 1994), and SW-2 through SW-4 (December 1993) collected from Grove Pond, which included full analyses of pesticides. Heptachlor was analyzed in some Plow Shop Pond sediment samples, and there were no exceedances. Pesticide exceedances occurred in the southwestern portion of Grove Pond, and along the Plow Shop Pond shoreline abutting the railroad causeway, the Railroad Roundhouse, and the west/southwest shoreline near Shepley's Hill Landfill.

PCBs were analyzed in Grove Pond sediments SED-A through SED-G, Sediment 1 through Sediment 6, and SW-2 through SW-4; and, nothing was detected.

VOCs were analyzed in sediment samples collected near the Railroad Roundhouse and in Grove Pond sediments SED-A through SED-G, Sediment 1 through Sediment 6, and SW-2 through SW-4; and, there were no exceedances. Acetone, methyl ethyl ketone and methylene chloride was analyzed for in sediment samples in Plow Shop Pond downgradient of SHL; and, there were no exceedances.

SVOCs were analyzed in sediment samples collected from Grove Pond and Plow Shop Pond. In Grove Pond, exceedances (anthracene, fluoranthene, fluorene, hexachlorobenzene, 2-methylnapthanlene, napthalene, phenanthrene and/ or pyrene) occurred in sediment samples GRD-95-08X, -09X, -14X, -15X, -26X, -27X, -29X, -31X, -33X, -36X, and -50X. For Plow Shop Pond, SVOC exceedances occurred in SESHL11 (pyrene) and SESHL 12 (benzoanthracene, chrysene, napthalene, phenanthrene and pyrene).

Other analyses for sediments included residue, hydrogen ion, and total organic carbon (TOC).

Surface Soil, < 1 foot below grade

Surface soil samples were collected at Faulkner Drive, PDC, along the shoreline of Grove Pond, and along the shoreline of Plow Shop Pond in the area of the railroad causeway and the Railroad Roundhouse. Surface soil samples were compared only to residential PRGs.

For Faulkner Drive, the samples were analyzed for metals, pesticides and PCBs, VOCs, and SVOCs. The metals with the most frequent exceedances were arsenic, antimony, and lead. However, there were some samples with exceedances for cadmium, chromium, mercury, manganese, nickel, and zinc. There were no exceedances for samples that were analyzed for pesticides, PCBs, or VOCs. There were exceedances of SVOCs; however, some of the exceedances appear to be method detection limits.

For PDC, surface soil samples were analyzed for metals only. Exceedances were found for aluminum, antimony, arsenic, chromium, iron, lead, mercury, methyl mercury, nickel, and zinc.

For samples collected along the Grove Pond and Plow Shop shoreline, exceedances are similar to what was found in sediments.

Deep Sediment and Subsurface Soil, > 1 foot below grade

Metals were analyzed in subsurface soil at Faulkner Drive, PDC, and the railroad causeway, and in 2 samples from Shepley's Hill Landfill. Metals were analyzed in deeper sediment/subsurface soil in Grove and Plow Shop Ponds. For Faulkner Drive, PDC, the railroad causeway, SHL, Grove and Plow Shop Pond, exceedances occurred primarily for arsenic, cadmium, chromium, lead, and mercury. However, exceedances also occurred for antimony, iron, magnesium, and zinc.

Pesticide analysis primarily included 4,4'-DDD, 4,4'-DDE and 4,4'-DDT collected from Plow Shop Pond samples. Full pesticide analysis was performed on soil samples collected from PDC. Endrin was analyzed in samples collected from Grove Pond. There were no pesticide exceedances.

PCBs were only analyzed for soil samples collected from PDC; and, there were no exceedances.

Trichlorofluoromethane was the only VOC analysis performed for soil/sediment deeper than 1 foot below grade. These samples were collected from deep sediments in Plow Shop Pond; and, there were no exceedances.

SVOCs were analyzed at PDC, Grove Pond near the tannery, Railroad Roundhouse, and Faulkner Drive. In Grove Pond, near the former tannery, benzo (a) pyrene exceeded the benchmark. Napthalene was identified as an exceedance at PDC. At the Railroad Roundhouse at various depths, various SVOCs were identified. Faulkner Drive had SVOC exceedances. There were no SVOC analyses for deep sediment or subsurface soil at Plow Shop Pond.

Surface Water

Gannett Fleming did not enter surface water analytical data from all reports obtained. Gannett Fleming reviewed the reports and entered data from Grove Pond (1992, 1995, 1998, 1999, and 2000) and Plow Shop Pond (1991, 1993, 1995, and 1998). Gannett Fleming also included surface water data from the EPA sampling effort in 2004. Analyses included total metals, dissolved metals, pesticides and PCBs, VOCs, and SVOCs.

Total metals exceedances were found in both Grove Pond and Plow Shop Pond. For Grove Pond, exceedances included arsenic, chromium, manganese, and iron. For Plow Shop Pond, exceedances from samples collected in 1991 included arsenic; however, in 1995 exceedances included aluminum, antimony, arsenic, chromium, iron, manganese, mercury and vanadium. (Note: the metal analysis for PSP in 1995 included a broader range of metals.)

Dissolved metal analysis was performed on surface water samples collected from Grove Pond and Plow Shop Pond. For Grove Pond surface water samples, exceedances included antimony, chromium, cadmium, manganese, and thallium. For Plow Shop Pond, four surface waters samples were collected in 1993 and one exceedance occurred for dissolved arsenic and manganese.

PCBs were only analyzed in surface water samples collected from Grove Pond; and, there were no exceedances.

Pesticides were analyzed in surface water samples collected from Grove Pond and Plow Shop Pond. There were no exceedances in the samples collected from Grove Pond. For samples collected from Plow Shop Pond, alpha-BHC and endrin were reported in the analyses. Endrin exceedances occurred in surface water collected from Plow Shop Pond.

VOCs were analyzed in surface water samples collected from Grove Pond and Plow Shop Pond. In 1993, surface water samples were collected from Grove Pond, and there were no exceedances. In 1995, six surface water samples collected from Grove Pond were reported to be analyzed for BEHP, five of the samples exceeded the PRG. In 1991, 14 surface water samples were collected from Plow Shop Pond; and, cis-1,2-dichloroethylene, methylene chloride, and chloroform were in exceedance of the PRGs.

SVOC analyses were performed on surface water samples collected from Grove Pond, and there were no exceedances.

Other analyses for surface water included: residue, TOC, inorganic analyses (non-metallic, i.e. alkalinity, chloride, nitrate), hardness, and hydrogen ion.

Groundwater

Groundwater data were not used in the risk assessments but were used to support the conceptual site model (CSM) and aid in background evaluations. Gannett Fleming did not enter groundwater analytical data from all reports obtained. We reviewed the reports and entered data that showed historical sampling events for SHL from 1991 through 2001. Data were entered from sampling events at PDC for August and November 1999. Samples were also entered into the database from Faulkner Drive (2000) and the railroad causeway (1993). Analysis included total metals at PDC and SHL; dissolved metals at Faulkner Drive and the railroad causeway; pesticide and PCB analysis at the railroad causeway; VOCs at Faulkner Drive, PDC, the railroad causeway, and SHL; and SVOCs were analyzed for at Faulkner Drive and the railroad causeway.

Total metals exceedances were discovered in groundwater collected from wells at PDC for arsenic, chromium, and mercury. For samples collected in association with Shepley's Hill Landfill, primarily the groundwater analysis included only arsenic and exceedances occurred in the majority of groundwater samples collected for arsenic analysis. However, there were samples collected from Shepley's Hill Landfill for a broader range of total metal analysis. Exceedances included primarily arsenic, chromium, iron, and manganese. There were some exceedances for thallium and vanadium.

Dissolved metal exceedanaces did not occur in groundwater samples collected from wells at Faulkner Drive; however, the summary tables reviewed in the reports are not detailed. The railroad causeway analysis was more complete; and, exceedances occurred primarily for manganese, with an exception of one sample (ERM-8) with groundwater exceedances for arsenic, iron, and manganese.

Pesticides and PCB analysis performed for groundwater samples collected from wells at the railroad causeway did not have groundwater exceedances.

VOCs were analyzed in groundwater collected from wells at Faulkner Drive; however, only 1,1,1-trichloroethane and 1,2,4-trimethyl benzene were reported, with 1,2,4-trimethyl benzene exceeding the benchmark in groundwater from 6 wells in February 2000. Groundwater samples collected from the railroad causeway were analyzed and reported for a broad range of VOCs; and, there were no exceedances. Groundwater samples collected from PDC were also analyzed and reported for a broad range of VOCs; and, there was one exceedance for 1,2,4-trimethyl benzene, one (1) exceedance for methyl tert-butyl ether (MBTE), and two exceedances for naphthalene. For Shepley's Hill Landfill, groundwater was collected for analyses of a select list of VOC contaminants: 1,1-dichloroethane, 1,2-dichloroethane, 1,2-dichloroethene, acetone, benzene, m-dichlorobenze, methyl isobutyl ketone, MBTE, o-dichlorobenze, p-dichlorobenzene, sec-butylbenzene, and xylene. Exceedances occurred at Shepley's Hill Landfill for benzene (3 exceedances in June 1999, 1 exceedance in November 1999, and 4 exceedances in May 2001); and p-dichlorobenzene (1 exceedance in May 2001).

SVOCs were analyzed in groundwater collected from 6 wells located at Faulkner Drive and 8 wells located at or near the railroad causeway. For Faulkner Drive, groundwater was collected and reported for a select list of SVOC contaminants: 1-methyl naphthalene, acenapthene, acenaphthylene, anthracene, fluoranthene, fluorine, naphthalene, phenanthracene, and pyrene. In 2000, two rounds of samples were collected; and, in total, there was one (1) exceedance for 1-methyl naphthalene and 6 exceedances for naphthalene. For the railroad causeway, in 1993 a full SVOC analysis was performed and there were no exceedances.

Biological Tissue Data

Several reports provided data for biological tissues. These were incorporated into the human health and ecological risk assessments. Chemical analyses were conducted for fish, frog, and invertebrate tissue, as well as tree swallow eggs and stomach contents. In addition, data from surface water and sediment toxicity tests were used in the ecological risk assessments. Please, refer to the human health and ecological risk assessments for a list of data sources and summaries of the data used for each assessment.

3.2.3 Validation Review

A validation review of the quality of the analytical data from the various investigations was conducted as part of the Data Gap Evaluation leading up to the ESI Report. The data that were determined to be usable in the ESI were used for site characterization, conceptual model development, and human health and ecological risk assessments.

Many reports were used to assemble the analytical database. These reports were reviewed to determine and evaluate:

1. The level of data validation or review performed at the time the data were generated,
2. The analytical protocols and laboratories utilized, and
3. The availability of Quality Assurance (QA) and Quality Control (QC) information.

The review conducted was similar to an EPA Region 1 Tier 1 data validation (EPA, 1996) review in that one of the goals was to determine whether there was enough information provided to conduct a higher level of data validation, if desired. The analytical data were generated over a period of 13 to 14 years, by various laboratories, and for many different reasons and entities. The documentation available for each of the data sets is as varied as the sources. It should be noted that none of the data appear to have undergone formal data validation as per EPA data validation guidelines (EPA, 1996).

In order to be able to justify combining any of these data sets in the future, minimum usability criteria were implemented to complete this review. Data were determined to be usable for ESI purposes under the following conditions:

1. EPA-approved or equivalent laboratory methods were used,
2. Data were generated by an EPA laboratory or under the Army Corp of Engineers analytical and review protocols,
3. Enough QA/QC information was provided in the report to perform a Tier II level data validation at some future time, or
4. EPA had already reviewed and accepted the data.

If none of the above conditions were met, the data set was assigned a “Not Acceptable” data usability code. These data were not used in the ESI.

As demonstrated in these tables, the vast majority of the data were determined to be usable based on the minimum usability criteria. For example, the human health risk assessment will not utilize data from samples that were field filtered or collected to support ecological studies. These types of use limitations will be identified in task-specific sections.

In addition, it may not be appropriate to combine data generated using different analytical methods for some purposes. For example, the metals data in the Haines (2001) report were generated using non-standard analytical methods. It may not be appropriate, in all cases, to combine those metals data with other metals data due to differences in the detection limits and other specifics of the methodologies.

4.0 SITE CHARACTERISTICS

4.1 Geology

There are bedrock outcrops in some locations within the Fort Devens reservation, and in other areas bedrock is buried by glacial deposits to depths of 200 feet or more. Primary post-glacial deposits are peaty swamp deposits found mostly along streams, surface water bodies; and artificial fill. Depth to bedrock beneath Grove Pond has not been verified; however, results of a seismic refraction survey close to Grove Pond indicate a layer that is believed to be consolidated till and/or bedrock at depths of 60 to 100 feet below grade. Unconsolidated, surficial material in the area consists of stratified glacial outwash (kame plain and kame terrace) deposits, primarily coarse sand and gravel. Logs from borings advanced along the south side of Grove Pond, close to the Town of Ayer wells, report fine to coarse brown sands and angular gravel. A gray silty layer, approximately 10 feet thick, was encountered at a depth of about 35 - 45 feet below grade in one well at the edge of Grove Pond (well 92-3; CDM, 1993). The lateral extent of this layer is unknown, although it has been inferred to be continuous beneath the pond based on the response of well 92-3 in the pump tests (CDM, 1993).

Bedrock underlying Fort Devens consists mainly of low-grade metasedimentary rocks, gneisses, and granites. These rocks range in age from Late Ordivician to Early Devonian (approximately 450 million to 370 million years old). A generalized summary map (Fig. 3-3 in Vol. I of the 1993 Remedial Investigation report; ABB-ES, 1993) identifies bedrock immediately to the south of Grove Pond as the Berwick Formation, and the Devens-Long Pond facies of the Ayer Granite is immediately to the west. It is noted in the Remedial Investigation that formation boundaries are approximate because bedrock exposures in this area are limited. However, this map indicates that in the vicinity of Grove Pond, the contact between the Berwick Formation and the Devens-Long Pond facies appears to strike in a northerly direction, passing between the western shore of Grove Pond and the eastern edge of Plow Shop Pond, approximately under the railroad causeway.

Results of a seismic refraction survey (cf. CDM, 1993) conducted by Geoscience Services Associates Inc. in 1991 did not confirm the presence of bedrock along a traverse parallel to the southern shore of Grove Pond near the Town wells. At this location, the lower layer is interpreted as dense till and/or bedrock, overlain by unconsolidated sands and gravels and was encountered at depths ranging from 48 feet to 116 feet below ground surface. However, the results of the seismic survey are ambiguous. Therefore, the subsurface elevation of the bottom of the Town of Ayer production well screens with respect to a dense till/bedrock layer is unknown.

The Berwick Formation is described as primarily calcareous and biotitic metasiltstones and metasandstone (Robinson and Goldsmith, 1991). Two localized zones of mica schists and phyllites containing pyrite (FeS_2) and pyrrhotite ($Fe_{1-x}S$) have been identified within the Berwick Formation. Both of these zones are thin, elongate bodies oriented in a northeast-southwest direction. The western sequence lies between Townsend and Chelmsford, directly north of Ayer. This sequence is described as a quartz-rich pyrrhotitic schist containing aggregates of biotite. Cores of the Berwick Formation, taken in the vicinity of the Shepley's Hill Landfill, have been studied extensively (ABB-ES, 1995a). From these cores, the metasiltstone is described as calcareous, with secondary quartz and sulfides along bedding planes and fractures.

4.1.1 Arsenic Mineralogy

Sulfide minerals include a large number of compounds with the general structural formula A_mX_p. In these minerals, the larger atom, may be S, As, Sb, Bi, Se, or Te. In a few minerals, S and As or Sb are present in nearly equal amounts. The smaller atom, A, is one or more of a group of metals that includes Fe, Co, Ni, Cu, Zn, Ag, Cd, and Mo.

The group of sulfide minerals with the formula AX_2 includes pyrite (FeS_2), cobaltite (CoAsS), arsenopyrite (FeAsS), and gersdorffite (NiAsS). The substitution of small amounts of Ni and Co for Fe in pyrite is not uncommon, but the mineral bravoite $(Ni,Fe)S_2$, in which Fe is less than 50 mole percent, is rare. Arsenopyrite is the most abundant arsenic mineral. It forms at high to moderate temperatures and is often found in association with other sulfide minerals in contact-metamorphic rocks (Mason and Berry, 1968).

Arsenic may substitute for sulfur atoms in some sulfide minerals -- for example, in pyrite or chalcopyrite ($CuFeS_2$), paired As-S atoms may substitute for S_2. Alternatively, arsenic may be present in pyrite or other sulfide minerals as a discrete phase (such as arsenopyrite). Both occurrences are commonly observed. In a letter report (Prof. M. Williams, Dept. of Geosciences, U. Mass. - Amherst to M. Deuger, Army BRAC Office, May 8, 1996), electron microprobe analysis of a sample of granite from a gravel pile on Devens verified the presence of discrete grains of arsenopyrite as well as pyrite with detectable As. The lithologic unit from which the gravel pile was mined is unknown, but it is probable that this material was locally derived.

Pyrrhotite ($Fe_{1-x}S$), niccolite (NiAs) and breithauptite (NiSb) belong to the niccolite group of sulfide minerals, all of which have AX-type structures (Mason and Berry, 1968). Pyrrhotite occurs primarily in basic igneous rocks but has also been reported from contact metamorphic rocks, in high temperature hydrothermal veins, and in sediments. Pyrrhotite has been found in association with pyrite, chalcopyrite ($CuFeS_2$), pentlandite $(Fe,Ni)_9S_8$, and other sulfide minerals. Experimentally, arsenic has been shown to substitute in the pyrrhotite crystal structure, and arsenopyrite has been found as a pseudomorph after pyrrhotite (Deer, Howie, and Zussman, 1966).

In summary, the presence of sulfide mineralization in bedrock outcrops on and near Ft. Devens, the identification of sulfides in bedrock core samples from the Berwick Formation, and the unequivocal identification of cobaltite in a bedrock sample from the south shore of Grove Pond

(Gannett Fleming, 2002), indicate that arsenic minerals are commonly-observed, naturally occurring geologic constituents of the bedrock in the vicinity of Grove and Plow Shop Ponds.

4.2 Hydrogeology

The groundwater hydrology of the Grove Pond area has been explored through various field investigations and numerical modeling (e.g., CDM, 1993; ETA, 1995). Grove Pond lies in a topographic depression, and the water table in the surficial aquifer generally mimics the topography. Under unstressed conditions (i.e., in the absence of pumping), groundwater flow in the immediate vicinity of the Town of Ayer wells is from southwest to northeast, and discharges to the pond. Similarly, flow in the area immediately north of the pond is toward the south, again discharging to the pond. The water-table gradient in the unstressed state is approximately 0.008 ft/ft beneath the slope descending toward the pond from the Devens boundary, and decreases to approximately 0.002 ft/ft near the Town of Ayer wells (estimated from the water table map shown in Figure 4-1, CDM, 1993). Horizontal hydraulic conductivity for the aquifer is approximately 300 ft/day (CDM, 1993), consistent with a pump test performed on the Ayer wells, as well as various independent determinations in the area. The ratio of horizontal to vertical hydraulic conductivity is estimated to be 10:1.

Under pumping conditions, the groundwater elevations are drawn down by several feet at the Town of Ayer production wells, and flow is drawn from the surrounding area, including the aquifer beneath the pond. The conceptual model invoked by most studies to date represents the outwash sand beneath the pond as a "semi-confined" aquifer; that is, the lower-conductivity pond-bottom sediments "cap" the underlying sand, offering resistance to infiltration from the pond, and supporting a vertical head difference. Under pumping conditions, the head in the underlying sand is lower than that due to the standing pond water, and recharge from the pond to the aquifer is induced. The flux of pond water through the bottom sediment and into the underlying sandy aquifer is determined by the distribution of the groundwater potential in the aquifer and the thickness and vertical hydraulic conductivity of the pond-bottom sediment. It is emphasized that the hydraulic properties of the pond-bottom sediment, critical to calculating the induced infiltration, have not been measured directly, or inferred from calibration of numerical models. In model studies performed to date, the conductivity of the pond sediment layer has been assumed to be similar to that determined in nearby surface water bodies (CDM, 1993) or to be some fraction of stream-bottom values characteristic of the region (ETA, 1995).

4.3 Meteorology

The Fort Devens climate is typical of the northeastern United States: long, cold winters and short, hot summers. The coldest months are January and February, with mean daily minimum temperatures of 17 °F; July is the hottest month, with mean daily maximum temperature of 83 °F. The mean annual temperature is 58 °F. During a normal year, the temperature reaches or exceeds 90 °F on 12 days, and 134 days of the year the temperature is at or below freezing.

The 1993 Remedial Investigation (RI) report for Fort Devens (ABB-ES, 1993) summarizes local climatic conditions as follows: Average annual rainfall is 39 inches. Mean monthly precipitation varies from a low of 2.3 inches (June) to a high of 5.5 inches (September). Average annual snowfall is 65 inches. Most of the snowfall occurs between December and March, although snow has been reported for the months of September through May. Wind speed averages 5 miles per hour (mph). The highest monthly average is 7 mph (March and April), and the lowest monthly average is 4 mph (September). Average daytime relative humidities range from 71 percent (January) to 91 percent (August). Average nighttime relative humidities vary between 46 percent (April) to 60 percent (January).

At Worcester (MA) Municipal Airport, approximately 25 miles to the southwest of the site, average annual rainfall for the period 1931 to 1997 is 46.84 inches. Average monthly rainfall over the same period at Worcester is quite uniform, ranging from 3.10 inches in February to 4.40 inches in November. Although conditions at Ft. Devens may deviate slightly from those recorded in Worcester, approximately 30 miles away, the Worcester meteorological station is the nearest station with consistent, continuous data.

5.0 CONCEPTUAL MODELS

This chapter presents conceptual models and supporting information for the presence of the principal chemicals of potential concern (COPCs) in sediment in Grove and Plow Shop Ponds. In this section, information that is often presented separately as "Nature and Extent" and "Fate and Transport" has been combined to reduce redundancy and for clarity in discussing a rationale for the concentration, distribution, plausible source(s), and transport mechanism(s) for each element of interest. The emphasis of this section is on elements and/or compounds that have been identified in previous studies of the ponds or in the present effort as potentially significant from a risk perspective. In particular, the report focuses on arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), and lead (Pb) in sediment. Briefer treatments of manganese (Mn) and vanadium (V) are given, as well.

Each of the key elements is treated in the following subsections. Each subsection, in turn, first offers a qualitative discussion of the concentrations and spatial distribution of the particular element. This discussion provides descriptive statistics for the element, and any observations of systematic variations within the system that may bear on interpretation of sources and transport processes. Second, a brief outline of the properties and processes believed to be of significance in the transport of the element in the ponds is given. Finally, a conceptual model is developed for the element. The conceptual model attempts to integrate what is known about historical activities around the ponds that may have contributed contaminants to the sediment, the spatial distribution of element concentrations, and the environmental behavior of the element. The objective of the conceptual model is to provide a general, interpretive framework that identifies likely source(s) and transport pathways for the element, and that is consistent with and supported by the available data. The depth of the discussion offered for each element is conditioned by the importance of the element with respect to the most recent human-health and ecological risk assessments (Sections 6.0 and 7.0, respectively). For that reason, arsenic and chromium, which are shown elsewhere to pose the most significant risks, are treated in somewhat more detail here.

It should be noted that the assessments provided in this section are based on a subset of the comprehensive database that was assembled in the course of completing the ESI. The comprehensive database attempts to bring together all available data from the many investigations that have been conducted on the ponds over approximately a 15 year time span. Although this large database has the potential to reveal systematic variations in contaminant concentrations at the scale of the ponds, and to provide relatively robust statistics, there are unavoidable inconsistencies within the data. The different investigations involved a variety of sponsoring agencies, sampling crews, field sampling methods, analytical laboratories, and evolving technologies. For these reasons, reported "non-detect" results from the laboratories imply a wide range of detection limits, and were discarded prior to calculating all sample statistics reported in this section. In addition, a number of results in the database were identified in review as questionable due to possible laboratory error, data transcription error, etc. These, too, were eliminated from the database prior to calculating descriptive statistics. That is, the discussion of conceptual models is based solely on what are believed to be "defensible" analytical results. Omission of non-detect analyses, rather than invoking some arbitrary substitution such as half the method detection limit, tends to bias the reported estimates of central tendency (i.e., arithmetic or geometric mean) high. The descriptive statistics summarized in this section are used solely for qualitative purposes to support the development of conceptual models for key elements.

In order to visualize the spatial distribution of key elements, bubble maps are provided for each element, with the exceptions of Mn and V. The data are presented for each pond separately, and for two depth intervals, 0-1 ft below the sediment/water interface ("shallow"), and >1 ft below the sediment/water interface ("deep"). The bubble maps display a name for every sample in the database; however, a bubble is plotted only for each detection. Non-detects are shown with the notation <MDL, where MDL is the reported detection limit. The area of each bubble is proportional to the concentration (in mg/kg) of the particular element displayed. Correspondingly, the diameters of the bubbles scale with the square root of the concentration. The bubble maps are provided in order to give a qualitative, visual impression of the distribution of detected concentrations. It is emphasized that the comprehensive data are assembled from all known sampling and analysis programs, and are not the result of a random sampling plan. For this reason, there are spatial biases in the database, e.g., higher sample density in known areas of concern, such as Tannery Cove in Grove Pond and Red Cove in Plow Shop Pond.

Histograms are presented for each element in each pond for the shallow (0-1 ft) sediment. The histograms show the frequency of occurrence of analyses within given ranges, based on $\log_{10}$-transformed concentrations (in mg/kg). It is often observed that various environmental parameters are log-normally distributed, and there is some indication that the measured concentrations of inorganics in the pond sediments tend toward this pattern. That is, the histograms of the log-transformed data are, in many cases, approximately Gaussian. The peak of such a histogram is centered on the geometric mean of the sample population, and the spread about that peak is measured by the geometric standard deviation. Elements that show marked departures from a log-normal distribution of concentrations, as well as a large spread in concentrations (i.e., large geometric standard deviation), are suggestive of anthropogenic inputs to the system. This is apparent, for example, in the histogram for chromium in shallow (0-1 ft) sediment in Grove Pond.

This section of the report does not attempt to address polycyclic aromatic hydrocarbons (PAHs), which have been detected in various locations in Grove and Plow Shop Ponds. Of particular note are detections in sediment in the vicinity of the former Railroad Roundhouse site on the south shore of Plow Shop Pond. Sediment toxicity tests conducted by EPA in 2005 using sediment from this area demonstrated lethal effects on both midge-fly larvae and amphipods. However, because most of the sediment sampling and analysis conducted over the past two decades has been directed primarily toward metals contamination, insufficient data are available to support the development of a conceptual model for PAHs. It is noted that additional investigation of sediment contamination immediately offshore from the Railroad Roundhouse is currently being undertaken by Army.

PCBs and pesticides also emerge from the present human-health risk analysis as risk drivers, and, like PAHs, are omitted from the discussion in this section. There are insufficient data for these analytes to support an interpretation of source(s) and transport.

5.1 Background:

According to the EPA guidance (2002), background is defined as:

1. *Naturally occurring*: present in the environment, not influenced by human activity

2. *Anthropogenic*: natural and man-made, present in the environment as a result of human activity but not specifically site-related

To date, there is no "sediment background" data set that has been collected explicitly for the purpose of establishing background concentrations of trace metals in Grove and Plow Shop Pond sediments. To assemble such a data set is difficult for the following reasons:

Data collected under a number of other programs (e.g., by Army, EPA, USF&W, USGS, etc.) suggest that the composition of groundwater discharging to these ponds is variable and location-dependent. Nevertheless, it has been documented that groundwater in the immediate vicinity of the ponds carries elevated levels of many of the elements of interest (particularly dissolved iron (Fe) and arsenic). Because the pond sediments are accumulating these elements through geochemical mechanisms such as sorption and precipitation, spatial variability, both vertically and laterally, in pond sediment composition is expected. It would be difficult to identify the number and location of pond sediment samples that adequately capture the range of conditions and concentrations represented in groundwater, even without consideration of any anthropogenic input.

In addition, both Grove and Plow Shop Ponds have existed, in an urban/industrial setting, for over 100 years. It is known that untreated tannery waste was discharged directly into Grove Pond at least throughout the first half of the 20th century (see, e.g., Gannett Fleming, 2002) and it is likely that other historical, industrial operations surrounding the ponds were also responsible for contributing some portion of the COPCs to the sediments. Unfortunately, records of operations and documentation of historical releases, either deliberate or unintended, are sparse. Thus, identifying the anthropogenic component of "background" in these sediments is extremely difficult.

Two sediment samples were obtained in Flannagan Pond and one was collected in Sandy Pond, both of which are located upstream from the study area. In addition, Norton, et al. (2001) analyzed one sediment core in Spectacle Pond, for comparison to cores that they collected from Grove Pond and Plow Shop Pond. However, the extent to which these ponds receive contributions from surface runoff, groundwater, and/or any anthropogenic sources that are different from inputs to Grove and Plow Shop Ponds is not known, and so these cannot be considered to represent "background" for the purpose of comparison to the subject ponds. In discussion of results from Flannagan, Sandy, and Spectacle Ponds, these locations will be referred to as "reference" areas rather than "background."

5.2 Pond Sediment Data Summary:

The following tables summarize descriptive statistics for seven key elements in each pond and for each of two depth intervals. Statistics for aluminum (Al) and iron (Fe) are also given because of their potential importance in the transport of the other metals. As noted in section 5.0, the dataset was first reviewed for questionable entries (e.g., possible faulty analyses, data-entry errors, etc.), and all non-detect (ND) results were omitted for the purpose of calculating the statistical parameters. In the following tables, the first column records the number of NDs present and the total number of samples present in the database. The succeeding columns display the arithmetic mean (AM), the arithmetic standard deviation (ASD), the minimum *detected* concentration (recall that, in many cases, lower concentrations may have been sampled, but are not considered if not detected), the maximum concentration, the geometric mean (GM) given as the arithmetic mean of the logarithm (base 10) of the concentrations, the geometric standard deviation (GSM) given in logarithmic (base 10) units, and the geometric mean given in mg/kg (GM (conc)). All concentrations are reported in mg/kg (ppm). Note that the descriptive statistics for vanadium and manganese are based only on data collected by EPA in 2004/2005, and thus represent a much smaller database than do those for the other elements shown in the tables. No deep (>1 ft) sediment from Grove Pond was analyzed in the EPA 2004/2005 program.

Tabulated Data for Grove Pond Sediments, 0-1 ft

	NDs/total	**AM**	**ASD**	**min.**	**max.**	**GM**	**GSD**	**GM (conc)**
Al	0 / 142	11200	13100	1320	90000	3.9024	0.3206	7990
Fe	0 / 142	15500	8640	93	42800	4.0985	0.3381	12500
Pb	2 / 142	271	337	3.29	1760	2.1248	0.5804	133
Hg	24 / 120	25.8	68.5	0.128	420	0.6080	0.7991	4.06
As	3 / 142	81.6	97.2	3.09	910	1.6975	0.4673	49.8
Cd	54 / 133	31.2	83.9	1	730	1.1193	0.5272	13.2
Cr	5 / 140	6050	12200	4.69	52000	2.6895	1.1243	489
V	0 / 17	66.5	39.7	22	140	1.76	0.24	57.3
Mn	0 / 17	981	469	70	1800	2.91	0.33	818

Note: NDs are not included in statistics

Tabulated Data for Grove Pond Sediments, >1 ft

	NDs/total	AM	ASD	min.	max.	GM	GSD	GM (conc)
Al	0 / 14	4770	1370	2060	7800	3.6602	0.1383	4570
Fe	0 / 14	5280	3260	1280	13900	3.6439	0.2828	4400
Pb	6 / 16	122	310	3.21	1000	1.2863	0.7854	19.3
Hg	3 / 10	27.1	55	0.0808	150	0.5369	1.087	3.44
As	7 / 16	167	426	2.86	1300	1.3983	0.7882	25.0
Cd	15 / 16	3.59		3.59	3.59	0.5551		3.59
Cr	0 / 16	3290	10900	4.69	44000	1.9721	1.2065	93.8

Note: NDs are not included in statistics

Tabulated Data for Plow Shop Pond Sediments, 0-1 ft

	NDs/total	AM	ASD	min.	max.	GM	GSD	GM (conc)
Al	1 / 108	8320	5370	388	27000	3.8106	0.3468	6470
Fe	0 / 108	58000	96300	428	410000	4.4217	0.5168	26400
Pb	9 / 108	188	210	3.88	1210	2.0042	0.5541	101
Hg	6 / 102	28.9	42.0	0.038	250	0.8721	0.8994	7.45
As	1 / 108	579	1060	3.49	6800	2.3365	0.6340	217
Cd	49 / 103	19.0	15.8	1.5	66	1.1316	0.3838	13.5
Cr	6 / 108	2590	4230	8.3	37800	2.9580	0.7827	908
V	5 / 20	39.2	22.5	7.1	80	1.50	0.32	31.8
Mn	0 / 20	3430	7350	130	34000	3.15	0.55	1410

Note: NDs not included in statistics

Tabulated Data for Plow Shop Pond Sediments, > 1 ft

	NDs/total	AM	ASD	min.	max.	GM	GSD	GM (conc)
Al	0 / 79	4950	4800	353	29000	3.5358	0.3875	3430
Fe	0 / 79	15900	31600	335	220000	3.7922	0.5587	6200
Pb	13 / 79	33.2	52.4	0.757	260	1.0554	0.6609	11.4
Hg	26 / 78	16.2	38.4	0.1	220	0.4027	0.8308	2.53
As	9 / 79	163	377	1.53	2500	1.5447	0.7668	35.1
Cd	71 / 79	97.7	166	3.6	430	1.2959	0.8306	19.8
Cr	12 / 77	477	999	4.6	5700	2.1027	0.7102	127
V	4 / 24	15.0	12.5	3.2	51	1.05	0.33	11.2
Mn	0 / 24	792	900	31	4500	2.68	0.49	475

Note: NDs not included in statistics

5.3 Arsenic

For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	As Concentration (mg/kg)
Flannagan Pond	110 and 55
Sandy Pond	47
Spectacle Pond*	18
Grove Pond*	~18-20
Plow Shop Pond*	~29-59

*Norton (2001) "background"

5.3.1 Distribution

5.3.1.1 Grove Pond

In Grove Pond surficial sediments (0 to 1 ft depth), 3 out of 142 samples reported non-detectable arsenic concentrations. Of the detected results, the arithmetic mean is 81.6 mg/kg and the geometric mean is 49.8 mg/kg (standard deviation of logs is 0.4673) (Fig. 5-1). Detected values range from 3.09 mg/kg to 910 mg/kg.

In deeper Grove Pond sediments (> 1 ft), 7 out of 16 samples reported non-detectable arsenic concentrations. Of the detected results, the arithmetic mean is 167 mg/kg and the geometric mean is 25.0 mg/kg (standard deviation of logs is 0.7882). Detected values range from 2.86

mg/kg to 1300 mg/kg. The sample reporting 1300 mg/kg, from Tannery Cove, is not only a statistical outlier but also is likely due to burial of tannery-contaminated material and thus is not true "deeper sediment." The next highest value in the deeper Grove Pond data set is 78 mg/kg. Without the 1300 mg/kg, the arithmetic mean of the Grove Pond deeper sediment arsenic concentrations is 25.6 mg/kg and the geometric mean is 15.3 mg/kg.

Arsenic values from shallow Grove Pond sediments are consistent with the upstream pond values, i.e. the arithmetic mean of 81.6 mg/kg is comparable to the values reported from Flannagan Pond (55 and 110 mg/kg) and Sandy Pond (47 mg/kg). There is at least one high value among the Grove Pond samples (the maximum observed, 910 mg/kg; GRD-92-03X, in Tannery Cove), and possibly a few more, but most of the data appear to be generally consistent with values reported from upstream locations. Overall, the data do not indicate that there has been extraordinary arsenic impact to Grove Pond sediments. There are a few elevated concentrations in and near Tannery Cove (e.g., GRD-95-27X, 340 mg/kg; Fig. 5-2), and it is possible that these sediments contain a component of contamination related to historical pesticide use at the tannery.

Data from the deeper Grove Pond sediments (Fig. 5-3) may be misleading because the sampling was biased toward Tannery Cove, and the "deep" samples probably were not always "deep." It is known that the sediments in the area of Tannery Cove have undergone considerable perturbation, including the deposition of fill in the cove, which would have buried earlier surficial sediments. Thus any tannery-related arsenic contamination may be present at depth when in fact it was originally deposited on the sediment surface. In addition, the deeper Grove Pond sediments comprise a small sample population (n = 9 reportable detections) and the geometric standard deviation is relatively large, reflecting this small sample size. The large scatter may be attributable to the few tannery-related high hits.

In the study by Norton, et al. (2001), arsenic concentrations are relatively low in the "asymptotic" portion of the sediment profiles (at a depth of approximately 50 cm; 18-20 ppm). The conceptual model developed by the authors of this study suggested that the arsenic was deposited from the "top down," so the deeper concentrations represent "ambient" material. However, this model neglects the possibility that some of the arsenic is accumulating in sediments by precipitation out of upwardly-discharging groundwater. It is known that groundwater on the south side of Grove Pond, in the vicinity of the Town of Ayer water-supply wells, is reducing and relatively high in dissolved arsenic and iron (maxima approximately 200 micrograms per liter and 22 mg/L, respectively; GF, 2002). This condition may exist elsewhere around Grove Pond as well as at other locations around Plow Shop Pond. When upward-moving, reducing groundwater reaches a redox boundary somewhere near the sediment-water interface and encounters more oxidizing conditions, the iron precipitates out as ferric oxides, hydroxides, or oxyhydroxides. These ferric iron phases are known for their capacity to sorb arsenic and other elements from solution. Thus, as groundwater passes through pond-bottom sediments, these elements may accumulate in the solid phase as a consequence of the redox controls on their mobility. Under this scenario, the sedimentary profile has an entirely different origin, and it may be perfectly consistent to find arsenic at higher concentration in the shallower sediment.

5.3.1.2 Plow Shop Pond

In Plow Shop Pond surficial sediments (0 to 1 ft depth), 1 out of 108 samples reported non-detectable arsenic concentrations. Of the detected results, the arithmetic mean is 579 mg/kg and the geometric mean is 217 mg/kg (standard deviation of logs is 0.6340) (Fig. 5-1). Detected values range from 3.49 mg/kg to 6800 mg/kg.

In deeper Plow Shop Pond sediments (> 1 ft), 9 out of 79 samples reported non-detectable arsenic concentrations. Of the detected results, the arithmetic mean is 163 mg/kg and the geometric mean is 35.0 mg/kg (standard deviation of logs is 0.7668). Detected values range from 1.53 mg/kg to 2500 mg/kg.

The average arsenic concentration in shallow sediments in Plow Shop Pond is notably higher than that in Grove Pond (579 mg/kg, compared to 81.6 mg/kg). However, it is apparent (see, e.g., Fig. 5-4) that the sampling in Plow Shop Pond has been biased toward Red Cove and the west side of the Pond. Because these areas were targeted for specific reasons (known high concentrations of arsenic and iron) and samples are not randomly located, the distribution and average arsenic concentrations in Plow Shop Pond cannot be considered to be "representative." The observed differences between arsenic concentrations in Grove Pond and Plow Shop Pond sediments are attributed primarily to differences in the groundwater chemistry that is discharging to the ponds. The southwest side of Plow Shop Pond, including Red Cove, is characterized by reducing groundwater bearing significantly elevated levels of dissolved arsenic (up to several hundred micrograms per liter). The reasons for the local / regional difference in groundwater compositions is not known at this point, but EPA is currently conducting a comprehensive study that focuses on groundwater-surface water interaction in Red Cove.

The database for deeper sediments in Grove Pond is small (n=9 detected values), with one sample reporting 1300 mg/kg; without this sample, the mean for Grove Pond deeper sediments is 25 mg/kg. The arithmetic mean of Grove Pond surface sediments is 81 mg/kg, suggesting a ratio of arsenic concentration in shallow sediments to deep sediments of approximately 3:1. In contrast, the concentrations in Plow Shop Pond sediments, both shallow and deep, are larger and the databases are larger (n = 107 and n = 70 detectable values, respectively). Overall, surface sediments in Plow Shop Pond are higher in arsenic (arithmetic mean = 579 mg/kg) than in Grove Pond, and the deeper sediments also report higher arsenic concentrations (163 mg/kg). However, the ratio of arsenic concentration in shallow sediments to deep sediments in Plow Shop Pond is also approximately 3:1. Thus, the observed distribution of arsenic in deep and shallow Plow Shop Pond sediments is consistent with the upward movement of groundwater bearing dissolved arsenic under reducing conditions and precipitation upon reaching a redox boundary near the sediment-water interface. A more detailed conceptual model is postulated in Sec. 5.3.3.

5.3.2 Transport Processes

The most common oxidation states in which arsenic occurs in the natural environment are +3, +5, and –3. In solution, the principal inorganic species are referred to as arsenate, or As(V), usually without regard to degree of protonation, and arsenite, As(III). Under moderately oxidizing conditions (ORP > +100 mV), arsenic occurs predominantly as As(V), while As(III) is present under moderately reducing conditions. As(V) sorbs more strongly, especially to hydroxide surfaces of iron, manganese, and aluminum. Cations, anions, and uncharged species are attracted to sites on these surfaces that may also be positively, negatively, or neutrally charged, i.e. represented as $Fe—OH_2^+$, $Fe—O^-$, and $Fe—OH^0$, respectively. Because As(III) species sorb less strongly, arsenic is both more mobile and more toxic in the trivalent state. The solubility, toxicity, mobility, and bioavailability of As(V) and As(III) have been addressed at length in a number of papers in the recent literature. Some excellent sources are the review papers by Bhumbla and Keefer, 1994; Smith et al, 1998; and Cullen and Reimer, 1989.

In oxygenated fresh waters in the pH range from ~5 to 9, the dominant As(V) species are $H_2AsO_4^-$ (from pH <3 to around pH 7) and $HAsO_4^{-2}$ (to pH ~11). The dominant As(III) species in this pH range is $H_3AsO_3^0$ (see, e.g., Cherry et al, 1979). The pH values measured in Grove Pond and Plow Shop Pond groundwater and surface water lie within this range. In anoxic systems, As(III) is the thermodynamically significant form. Under extremely reducing, acidic conditions and in the presence of sulfur, As_2S_3 (the mineral orpiment) or AsS (realgar) may form. At neutral to alkaline pH, thioarsenite species, including $AsS(SH)(OH)^-$, $As(SH)S_2^{2-}$, AsS_3^{3-} and $As(SH)_4^-$ complexes, may be important (Bostick et al., 2005).

The redox behavior of arsenic in natural systems is complex. Thermodynamically, As(V) should be the dominant form relative to As(III). A recent study of arsenic in groundwater in a glacial-till aquitard system presents evidence of the suitability of using the As(V)/As(III) redox couple as an indicator of the oxidation-reduction potential of the system (Yan et al, 2000). However, thermodynamically predicted As(V)/As(III) ratios are rarely observed, and it is probable that relative concentrations of these species are affected by microbial reactions.

Both pH and microbial activity influence the oxidation of arsenite to arsenate, and the reduction of arsenate to arsenite. Bacteria, fungi, and some plants convert inorganic arsenic to organic forms (e.g., various methylated species such as monomethyl and dimethyl arsenic). Some of the organic species are volatile (e.g. dimethyl arsine) but the predominant species are non-volatile or semi-volatile (Argonne National Laboratory, Human Health Fact Sheet, August 2005). Concentrations of organic arsenic species are controlled by the composition of the microbial population; nature and concentration of organic matter; redox conditions; pH; mineral composition; and moisture. A more detailed description of these processes, as well as an extensive discussion of the bacterial methylation of arsenic, and a discussion of the uptake of arsenic by terrestrial and aquatic plants, is found in Cullen and Reimer, 1989.

5.3.3 Conceptual Model

Arsenic is a naturally occurring element that is commonly found in New England soils and groundwater. Originally associated primarily with sulfide minerals in bedrock, arsenic is redistributed throughout the overburden by physical (e.g. glacial erosion and transport) and chemical processes (e.g., dissolution, precipitation, adsorption). In addition, anthropogenic arsenic sources include waste incineration, coal combustion, metal mining, pesticide and herbicide applications, and use as a wood preservative. Potential sources that may have contributed arsenic to Grove Pond and Plow Shop Pond include local apple orchards, the leather tannery, and numerous historical industrial operations surrounding the ponds.

Concentrations of arsenic in Grove and Plow Shop Ponds are clearly elevated in places and exceed some standard risk thresholds (e.g., secs. 6 and 7). One distinct "hotspot" occurs along the southwest shore of Plow Shop Pond (see Fig. 5-4). In July 2004, EPA sampled groundwater via GeoProbe at several points around Plow Shop Pond. Two of these were located immediately adjacent to Red Cove, in order to characterize the vertical distribution of arsenic and other parameters in groundwater discharging to the cove (EPA data, July 2004). Data from these vertical profiles show that ORP ranges from -133.9 mV (at a depth of 30-32 ft BGS immediately adjacent to Red Cove) to +94.7 mV (at a depth of 6-8 ft BGS near the Plow Shop Pond dam). Dissolved arsenic ranges from non-detect at 1 microgram per liter to several hundred ppb (maximum 740 ppb, at a depth of 14 ft below ground surface (BGS) near Red Cove); and dissolved iron is present at concentrations between 430 and 72000 micrograms per liter. ORP generally decreases with depth below ground surface, pH increases, and both iron and arsenic concentrations increase as ORP decreases (Fig. 5-6). The positive correlation between dissolved arsenic and iron observed in these data suggests that reductive dissolution of ferric oxyhydroxides in the overburden and release of sorbed constituents is responsible for the elevated arsenic in groundwater discharging toward the Cove. When this reducing groundwater reaches a redox interface, the ferrous iron in solution forms a number of phases that sorb arsenic and other dissolved trace metals (LaForce et al., 2000; Harrington et al., 1998; Brannon and Patrick, 1987; and Moore et al., 1988).

The association of reducing groundwater with high Fe and high As concentrations is observed throughout the region. While the presence of Shepley's Hill Landfill may be a factor in mobilization of Fe and As in groundwater reaching Red Cove, the extent to which anthropogenic versus natural processes are responsible for high As concentrations in Plow Shop Pond (specifically in Red Cove) is currently unknown. Ongoing investigations by the EPA and Army may provide additional insights into the cause of the low-ORP, high-Fe, high-As groundwater on the east side of the landfill. In the fall of 2005, EPA Office of Research and Development (ORD) personnel began a focused investigation of groundwater-surface water interaction in the vicinity of Red Cove. A key objective of their study is the identification of the processes that control arsenic behavior at Red Cove. As part of this study, groundwater, surface water, pore water, and sediments have been sampled and will be characterized for a more comprehensive understanding of the mechanisms that determine arsenic mobility at this location. Documentation is anticipated in 2007. In addition, Army is undertaking a Comprehensive Site Assessment and a Corrective Action Alternative Analysis for Shepley's Hill Landfill, which may also provide insight into the relationships between the landfill, groundwater geochemistry, and groundwater – surface water interaction. Pending results of these studies, no definitive conclusions can be drawn regarding the role of the landfill in mobilizing arsenic transport to Red Cove. This question is beyond the scope of the present report.

Conclusions (Arsenic):

The following points are offered in support of the 'weight of evidence' conclusion that elevated levels of arsenic in Grove Pond and Plow Shop Pond sediments, particularly in the vicinity of Red Cove, are due to accumulation from groundwater:

- Low-ORP, high-Fe, high-As groundwater is known to be discharging toward the Cove (supported by EPA 2004 groundwater data);

- Presence of low-ORP, high-Fe, high-As groundwater and high-As sediments elsewhere, at locations not impacted by landfills (e.g., Grove Pond);

- Observed oxidation and precipitation of iron, as Fe(III) oxide phases, in Red Cove sediments (i.e., the red floc often observed on the sediment surface);

- Known affinity of hydrous ferric oxides for arsenic and other trace metal species in solution, resulting in the observed association of Fe and As in a fixed ratio in pond sediments (Fig. 5-7);

- Decrease in sediment arsenic concentration along west side of Plow Shop Pond, approaching the 'hinge' where the more oxidizing pond water is recharging groundwater;

- Lack of a plausible anthropogenic explanation for fairly uniform but elevated As concentrations in sediments across both Grove and Plow Shop Ponds (with the exception of Red Cove), both of which are shallow, low-energy environments unfavorable to large-scale sedimentary mixing;

- Accumulation of arsenic in sediments at redox boundaries is a recognized phenomenon.

In addition, arsenic may be precipitating in pond sediments in sulfide phases that may include either discrete As-sulfides such as orpiment (As_2S_3) or realgar (As_2S_2), or in association with Fe-sulfides (Huerta-Diaz et al., 1998). Although this mechanism is incompletely understood at present, the formation of arsenic phases under sulfidic conditions is the subject of ongoing research (e.g., Wilkin and Ford, 2002; Wilkin, 2001; Wilkin et al., 2002). The precipitation of realgar has been reported in marine sediments (O'Day et al., 2004) and the precipitation of arsenic sulfides has been postulated as an explanation of the observed decrease in aqueous arsenic concentrations in very low-ORP groundwater at several sites in New England (Stein, et al., 2005). While no data currently exist to support the occurrence of this mechanism in sediments from Grove or Plow Shop Pond, EPA investigators (study in progress; Ford et al., 2006) have observed zones of black, organic-rich sediment in shallow cores taken in Red Cove. Results obtained by Ford and co-workers from such intervals will yield insights into the nature of As or As-Fe phases forming under anoxic conditions in Plow Shop Pond sediments.

In Grove Pond, another "hotspot" is observed in the vicinity of Tannery Cove. It is probable that arsenical pesticides were used at the tannery, but this mass contribution is minor compared to contributions from groundwater (see, e.g., Fig. 5-1), especially on the southwest shore of Plow Shop Pond. Sample GRD-95-26, located in Tannery Cove and at a depth of 3 ft, reported 1000 mg/kg Pb and 1300 mg/kg As, which may be indicative of the use of lead arsenate, an insecticide that first came into use in Massachusetts in 1892 (Peryea, 1998). In the same sample, Cr and Hg are reported at 44000 mg/kg and 150 mg/kg, respectively, and these elements are also consistent with tannery-related chemicals. It is apparent that this sample contains some component of contamination from the tannery, but the depth of this sample suggests that the contamination was initially a surficial deposit that was subsequently buried by fill.

5.4 Cadmium

5.4.1 Distribution

Cadmium does not prove to be a major risk driver for either human health or ecological receptors in the present assessment (Secs. 6 and 7). However, it has been singled out previously as a contaminant of potential concern (e.g., ABB, 1995). For this reason, a brief discussion of the distribution of cadmium in the ponds is offered here for completeness. For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	Cd Concentration (mg/kg)
Flannagan Pond	11 and 13
Sandy Pond	<3
Spectacle Pond*	0.44
Grove Pond*	~0.2 – 0.38
Plow Shop Pond*	~<0.2 – 0.58

*Norton (2001) "background"

5.4.1.1 Grove Pond

The distribution of cadmium detections in shallow (0-1 ft) sediment samples from Grove Pond is shown in Figure 5-8. There is no obvious spatial pattern of cadmium concentrations. The maximum detection is 730 mg/kg, in a sample at the west end of the pond, adjacent to the railroad causeway. This is an outlier within the available data; the next highest detection is 130 mg/kg, located in the center of the pond. Cadmium was not detected in 54 of 133 samples in the database for shallow sediment. The arithmetic mean of the 79 detections is 31.2 mg/kg; the geometric mean is 13.2 mg/kg (Fig. 5-9). The geometric mean is nearly identical to that for Plow Shop Pond detections (13.5 mg/kg). That is, this measure of central tendency does not distinguish the two ponds.

Based on his own more limited sampling (three cores and ten surface grab samples), Norton (2001) suggests that there is a preponderance of higher concentrations in the eastern end of Grove Pond. Based on the comprehensive data displayed in Figure 5-8, this pattern is not strongly supported. Norton calculated an arithmetic mean of 12 mg/kg for his ten surface sediment samples, within a factor of 2 to 3 of the mean calculated for the comprehensive data set.

Cadmium was detected in the two upstream reference samples from Flannagan Pond at 11 and 13 mg/kg, and was ND (<3 mg/kg) in the single upstream reference sample from Sandy Pond. Based on this very small sample set, there is nothing to distinguish shallow-sediment Cd detections in the upstream reference ponds from those in Grove Pond.

Sampling of deep (>1 ft) sediment in Grove Pond is relatively sparse, and Cd was detected in only one of fifteen samples, at a concentration of 3.59 mg/kg (Fig. 5-10). Based on these limited data, it appears that cadmium concentrations at depth are lower overall than those in the upper 1 ft of sediment.

5.4.1.2 Plow Shop Pond

The distribution of cadmium detections in shallow (0-1 ft) sediment samples from Plow Shop Pond is shown in Figure 5-11. There is some suggestion that the higher detections tend to be more concentrated toward the western shore. The maximum detection is 66 mg/kg, in a sample in the southwest portion of the pond known as Red Cove. Cadmium was not detected in 49 of 103 samples in the database for shallow sediment. The arithmetic mean of the 54 detections is 19.0 mg/kg; the geometric mean is 13.5 mg/kg (Fig. 5-9). The geometric mean is nearly identical to that for Grove Pond detections (13.2 mg/kg). That is, this measure of central tendency does not distinguish the two ponds.

For comparison, Norton (2001) reports an arithmetic average for Cd in 10 shallow-sediment grab samples of 6 mg/kg, about one third of the result for the larger database considered here. The estimates of central tendency for Cd in shallow sediment in Plow Shop Pond (arithmetic mean: 19.0 mg/kg; geometric mean: 13.5 mg/kg) are comparable to the single-sample results for the upstream reference ponds (one ND, and detections of 11 and 13 mg/kg).

The majority of deep sediment samples (>1 ft) from Plow Shop Pond (Fig. 5-12) did not yield detectable cadmium; 71 of 79 samples were ND. Two samples show anomalously high detections. The highest cadmium concentration found in deep Plow Shop Pond sediment is 430 mg/kg at a depth of 1.5 ft, immediately off the Railroad Roundhouse site (PSPC09). The other high detection is in Red Cove (PSPC19), with a concentration of 290 mg/kg at a depth of 3.5 ft. The arithmetic mean of the 8 detections in deep sediment is 97.7 mg/kg; the geometric mean is 19.8 mg/kg. Note that these values are not indicative of the central tendency across the pond, because they give no weight to the non-detects, which dominate the overall dataset. In addition, it is noted that both the area off the Railroad Roundhouse site and the area of Red Cove may have received an input of sediment due to various site activities (e.g., erosion from the steep slopes between the roundhouse and the pond and between Shepley's Hill Landfill and the pond), so that "deep" (>1 ft) sediment may have been closer to the sediment – water interface in relatively recent years.

5.4.2 Transport Processes

Cadmium occurs as Cd^{2+} and in a variety of Cd(II) solids (e.g., CdO, $CdCO_3$, $CdCl_2$, $CdSO_4$, CdS). Like other metal cations, cadmium sorbs onto oxyhydroxides of Fe, Al, and Mn. In an aqueous environment, cadmium will eventually precipitate as an oxide or a sulfide, depending upon local redox conditions and the availability of reduced sulfur.

5.4.3 Conceptual Model

Cadmium appears to be somewhat elevated in Grove Pond and Plow Shop Pond shallow sediment relative to what might be considered "background" for the area. Norton (2001) collected and analyzed a core from Spectacle Pond, located about 3.5 miles to the east, as representative of a nearby pond not subject to historical industrial activities. The highest Cd detected in the Spectacle Pond core was 1.64 mg/kg. In contrast, central tendency estimates for Grove and Plow Shop Ponds shallow sediment (0-1 ft) are of the order of tens of mg/kg. Cadmium in the ponds generally shows no systematic spatial variation in map view, suggesting that its presence may be related to widespread urban and industrial activities surrounding the ponds. Scattered high values, such as the 730 mg/kg detection near the western shore of Grove Pond, may reflect sporadic, local sources. There is a suggestion of higher concentrations (of the order of tens of mg/kg) along the southern and western shores of Plow Shop Pond (Fig. 5-11). It is possible that the Cd originates in adjacent soils, and that the clastic sedimentation rate is somewhat higher in these areas because of relatively steep slopes and some bare ground on the shore. This speculation is further supported by the observation of detections of Cd in the deep (>1 ft) sediment in the same areas. Elsewhere, there is a striking contrast between shallow sediment (0-1 ft), in which nearly half of all samples show detectable cadmium, and deeper sediment (>1 ft), in which Cd was detected in less than 10% of all samples.

Cadmium enters the environment via a number of uses. It is present in petroleum and coal, and is consequently released to the atmosphere in combustion products, and subsequently deposited to surface soil and water. In addition, particulates from tire wear contribute Cd near roads (California Air Resources Board, 2004). Cadmium is used extensively in batteries. One possible use near the ponds is in vented Ni-Cd batteries, often used in diesel locomotives, which are known to release Cd to the environment (Dartmouth Toxic Metals Research Program, 2005). Cadmium is also widely used as a pigment in paints, plastics, ceramics, enamels, and glass; its use in dyes goes back to the 19^{th} century and before. Historical maps and drawings of the Town of Ayer show an industrial facility on the north shore of Plow Shop Pond in the late 19^{th} century labeled Nashoba Mordant and Dye Company; it is unknown whether or not this business manufactured or handled cadmium-based pigments. Other possible industrial users of Cd include the former tannery and the present-day plastics business on the northwest shore of Grove Pond. Cadmium is added to plastics not only as a pigment, but also as a stabilizer against degradation by light and temperature (ATSDR, 1999). Cadmium has been used in rare instances in the tanning process (Dartmouth Toxic Metals Research Program, 2005), but there is no indication of a spatial association with the tannery site on Grove Pond, or any apparent correlation with more unequivocal tannery contaminants, such as chromium.

Detections of Cd at concentrations of several hundred mg/kg in deep Plow Shop Pond sediment adjacent to the Railroad Roundhouse and in Red Cove appear to be isolated, and are of unknown origin. Both areas may have been subject to relatively rapid sedimentation due to erosion of the steep slopes between the roundhouse and the pond and between Shepley's Hill Landfill and the pond, so that material that was at the sediment – water interface during the 20^{th} century is now buried to depths up to several feet.

It is noted in the comprehensive data for sediment in Grove and Plow Shop Ponds that there is a rather strong empirical correlation between cadmium and lead. Figure 5-13, for example, shows that the ratio of Pb to Cd is constant over the upper 15 cm of Grove Pond Core #1 analyzed by Norton (2001). Such a correlation is suggestive of either a common source (i.e., Cd and Pb were released to the environment in a roughly fixed proportion, which is retained through their transport and accumulation processes in the ponds), or common controls on transport once in the environment (i.e., the sources may be different, but the predominant transport processes tend to distribute the metals spatially in a similar fashion). The former scenario is consistent, for example, with a source in combustion of leaded fuels with minor Cd impurities. At depth (Fig. 5-13), the Cd concentrations decrease more rapidly than do the Pb concentrations; no explanation for this systematic variation has been identified.

In summary, cadmium is somewhat elevated in shallow sediment across both ponds, at geometric mean concentrations of the order of 10 mg/kg. The widespread presence of Cd is likely attributable to deposition from the atmosphere and from particulates carried to the ponds in stormwater runoff. In addition, there are sporadic, local concentrations of the order of hundreds of mg/kg, possibly related to historical industrial and transportation activities around the ponds.

Specific discrete sources are not indicated by the available data, and ultimate sources of release remain unknown.

5.5 Chromium

5.5.1 Distribution

For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	Cr Concentration (mg/kg)
Flannagan Pond	21 and 14
Sandy Pond	27
Spectacle Pond*	24
Grove Pond*	~30-35
Plow Shop Pond*	~8-50

*Norton (2001) "background"

5.5.1.1 Grove Pond

In Grove Pond surficial sediments (0 to 1 ft depth), 5 out of 140 samples reported non-detectable chromium concentrations. Of the detected results, the arithmetic mean is 6050 mg/kg and the geometric mean is 489 mg/kg (standard deviation of logs is 1.1243) (Fig. 5-14). Detected values range from 4.69 mg/kg to 52000 mg/kg.

In deeper Grove Pond sediments (> 1 ft), 0 out of 16 samples reported non-detectable chromium concentrations. The arithmetic mean is 3290 mg/kg and the geometric mean is 93.8 mg/kg (standard deviation of logs is 1.2065). Detected values range from 4.69 mg/kg to 44000 mg/kg.

Chromium concentrations in sediments from the reference areas are remarkably uniform, generally around ~ 20 to 30 mg/kg, suggesting that this is a "typical" ambient Cr value. However, extreme values – up to three orders of magnitude higher than the background range – are likely due to anthropogenic impacts. The distribution of these extreme concentrations (Fig. 5-15) indicates an association with the former tannery, with some transport to the east and also to the west, through Plow Shop Pond. Also, the very high values in deep sediment (Fig. 5-16) are located in Tannery Cove. Although initially tannery-related and likely the result of surface deposition, these concentrations are found in sediments that are now deep due to burial by in-filling of the cove. The standard deviations of the logarithmically transformed data from Grove and Plow Shop Ponds are high, due to the large spread in the data. Figure 5-14 shows the distributions of Cr data from Grove and Plow Shop Ponds.

In addition to the high Cr concentrations found near the former tannery site, two sediment samples from the southwest cove of Grove Pond exhibit elevated Cr. Samples GRD-95-29X and GRD-95-46X are reported at 20400 mg/kg and 2010 mg/kg, respectively. The higher of these two is among the samples exhibiting a correlation between Cr and Hg, suggesting a possible association with tannery-derived contamination.

5.5.1.2 Plow Shop Pond

In Plow Shop Pond surficial sediments (0 to 1 ft depth), 6 out of 108 samples reported non-detectable chromium concentrations (Fig. 5-17). Of the detected results, the arithmetic mean is 2590 mg/kg and the geometric mean is 908 mg/kg (standard deviation of logs is 0.7827) (Fig. 5-14). Detected values range from 8.3 mg/kg to 37800 mg/kg.

In deeper Plow Shop Pond sediments (> 1 ft), 12 out of 77 samples reported non-detectable chromium concentrations (Fig. 5-18). The arithmetic mean is 477 mg/kg and the geometric mean is 127 mg/kg (standard deviation of logs is 0.7102). Detected values range from 4.6 mg/kg to 5700 mg/kg.

5.5.2 Transport Processes

The most common oxidation states of chromium are Cr^0, Cr^{+3} (trivalent chromium) and Cr^{+6} (hexavalent chromium). Most naturally occurring chromium is in the form of Cr(III), while anthropogenic chromium enters the environment usually as Cr(III) or Cr(VI). Most Cr(VI) salts have high solubilities, while the solubilities of Cr(III) solids (oxides, hydroxides, or oxyhydroxides) are low, of the order < 0.05 parts per billion at pH = 6 (James, 2002). Chromate is a strong oxidant, and Cr(VI) is relatively easily reduced in the environment by interaction with such common reductants as Fe(II) and organic matter (Rai et al., 1989). The oxidation of Cr(III) to Cr(VI) is slow and controlled primarily by Mn-oxide. Cr(III) either sorbs or precipitates readily, through adsorption onto ferric oxyhydroxides; by precipitation as a discrete Cr-oxide or oxyhydroxide; or through substitution of Cr^{+3} for Fe^{+3}, due to their similar ionic radius and charge, and precipitation as a mixed Cr^{+3}--Fe^{+3}oxide, hydroxide, or oxyhydroxide, e.g. $(Cr_xFe_{1-x})(OH)_3$. In the pH range from 4 to 9 and at redox potentials (Eh) between approximately +250 and +750 mV, the dominant Cr(VI) species in solution are $HCrO_4^-$ and CrO_4^{-2}. At lower Eh and with increasing pH, Cr(III) species are Cr^{+3}, $Cr(OH)^{+2}$, $Cr_3(OH)_4^{+5}$, $Cr(OH)_2^+$, and $Cr(OH)_{3(aq)}$ (calculated using Geochemist's Workbench; Bethke, 19xx; at 25 °C, chromium activity = 10^{-5}). In solution, aqueous concentrations of Cr(VI) are controlled mainly by adsorption/desorption and precipitation/dissolution reactions under neutral to acidic conditions, while Cr(III) concentrations are determined primarily by precipitation/dissolution of Cr(III) solids (Rai et al., 1989).

The solubility of Cr(III) may be enhanced by complexation or chelation with organic molecules. It is known, for example, that organic acids containing carboxyl groups (e.g., --RCOOH) can coordinate with Cr(III) to form complexes that may remain in solution for days to months.

Factors affecting the solubility of Cr(III) in these forms include pH, light, concentration and molecular weight of organic acids, and microbial activity (James, 2002; James and Bartlett, 1983; Srivastava et al., 1999). The accumulation of Cr by aquatic plants is also known (e.g., Cossich et al., 2002). The large amount of aquatic vegetation observed in both Grove and Plow Shop Ponds may have played a significant role in the distribution of chromium, originating at the former tannery site, in pond sediments. However, the extent to which chromium transport in the ponds has occurred, either as organic complexation of Cr(III) or sorption/uptake by aquatic plants, is unknown and cannot be determined from currently available data.

5.5.3 Conceptual Model

Known uses of chromium (both Cr(III) and Cr(VI)) include chrome plating operations, the manufacture of dyes and pigments, steel-making, leather tanning, wood preservation, and as rust and corrosion inhibitors and algaecides in industrial processing water. In addition, chromium compounds are also used in the textile industry as mordants, and lead chromate ("chrome yellow") is a pigment that is used in paints, plastics, and printing ink. At least two historical industries that may have used some of these chromium compounds were located in the immediate vicinity of the ponds, including the Nashoba Mordant and Dye Company, located at the northern end of Plow Shop Pond, and the tannery at the northwest corner of Grove Pond.

In the leather-tanning process, chromium salts are commonly used, most often as a basic Cr(III) sulfate. Hides are pickled in an acidic solution at a pH of 3, the chrome solution is introduced, and the pH is increased. Because the tannery discharged an untreated waste stream directly into Grove Pond from the beginning of operations in the mid-19th century until the middle of the 20th century, it is likely that Grove and Plow Shop Pond sediments contain some component of tannery-related chromium contamination. Some Cr (III) precipitates as mixed Cr-Fe oxide or is removed from solution by adsorption onto Fe (and/or Al, Mn) oxides in sediment. In addition, organic complexation of Cr(III) and/or uptake of Cr by suspended aquatic vegetation can enhance chromium mobility and may account for the observed distribution in pond sediments, particularly in Plow Shop Pond. Such processes may also bear on the apparently anomalous detection of chromium at 20,400 mg/kg in the southwest cove of Grove Pond.

The Massachusetts Department of Environmental Protection performed an investigation of the former tannery site in 1999 (MADEP, 2000) that included sampling of soils and groundwater, as well as adjacent sediment and surface water in Tannery Cove. Although high concentrations of chromium were detected in site soils (maximum 63,800 mg/kg at 9-11 ft bgs in the boring for MW-6), groundwater concentrations were relatively low (maximum (dissolved) 69 µg/L at PZ-1R, November 1999). The MADEP concludes, Calculations based on data from the piezometers, seepage meters, and monitoring well indicate that under current conditions, transfer of metals from groundwater to Grove Pond sediments near the PDC site is not a significant source of metals in the sediments." (MADEP, 2000, sec. 9.40, p. 30)

It is notable that chromium concentrations in shallow (0-1 ft) sediments are ubiquitously high across Plow Shop Pond (Fig. 5-17); many samples report Cr at least two orders of magnitude above the reference area concentrations. Although there is little doubt that the tannery contributed significant quantities of chromium to the pond system, questions of additional sources and transport mechanisms remain open to speculation.

Elevated concentrations (of the order of thousands of mg/kg) are found in deep sediment (>1 ft) along the southern and western shores of Plow Shop Pond (Fig. 5-18). It is possible that the Cr was originally deposited at the water/sediment interface, and subsequently buried to appear in "deep" sediment. As noted in the discussion of Cd in deep Plow Shop Pond sediment (sec. 5.4.3), there are suggestions that the clastic sedimentation rate is somewhat higher along the southern and western shores because of relatively steep slopes and some bare ground.

Chromium may have been used to treat industrial-process waters that were discharged to one or both ponds, as an algaecide or a rust inhibitor. A good-faith effort was made to search the records of the Town of Ayer for any information that such treatments might have contributed to the Cr load in pond sediments, without success. Inquiries to the Town of Ayer regarding this question did not produce any response, so any direct anthropogenic contributions cannot be established with certainty.

Conclusions (Chromium):

Any interpretation is largely speculative, given the available data and information on industrial use or discharge of these elements. Nevertheless, the following points are offered in support of the 'weight of evidence' conclusion that elevated levels of chromium in Grove Pond and Plow Shop Pond sediments are due to waste discharged by the former tannery and transported by dissolved or suspended organic matter:

- Cr(III) may remain in solution for long periods when in the form of organic complexes

- Uptake/accumulation and mobilization by aquatic vegetation is a plausible mechanism, given the amount of biomass in each of the subject ponds

- The highest Cr concentrations and the highest Pb concentrations are strongly correlated ($R^2 > 0.9$) and are found in sediments from Tannery Cove (Fig. 5-19). Elsewhere in both ponds, the correlation between Cr and Pb is weak or non-existent. This observation is consistent with postulated uses of both Cr (in the tanning process) and Pb, possibly as an arsenate pesticide, at the tannery.

- Chromium is correlated with mercury in both Grove and Plow Shop Pond sediments (Fig. 5-20), suggesting a possible common source and transport mechanism (see Conceptual Model for Hg in Sec. 5.6.3). The data shown in Fig. 5-20 for Grove Pond sediments indicate two possible Cr/Hg trends, possibly indicating that two different mechanisms may be responsible for their behavior in pond sediments, such as abiotic and inorganic adsorption (e.g., onto Fe(III) phases) and organic and/or aquatic-plant controlled uptake and deposition.

5.6 Mercury

5.6.1 Distribution

For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	Hg Concentration (mg/kg)
Flannagan Pond	0.3 and 0.3
Sandy Pond	0.62
Spectacle Pond*	0.112
Grove Pond*	~0.090 – 0.180
Plow Shop Pond*	~0.170 – 2.323

*Norton (2001) "background"

5.6.1.1 Grove Pond

The distribution of mercury detections in shallow (0-1 ft) sediment samples from Grove Pond is shown in Figure 5-21. There is a clear preponderance of higher concentrations in the northwestern portion of the pond, known as Tannery Cove. The maximum detection is 420 mg/kg, in a sample in this area (GRD-92-03X). The second highest detection is also in Tannery Cove, at 340 mg/kg (GP13). Mercury was not detected in 24 of 120 samples in the database for shallow sediment. The arithmetic mean of the 96 detections is 25.8 mg/kg; the geometric mean is 4.06 mg/kg (Fig. 5-22). (Note that the apparent anomaly on the bubble plot (Fig. 5-21) in the far SW cove of Grove Pond is a data-entry error. The reported Hg concentration there is 4.22 mg/kg. It is entered in the database at 422 mg/kg. The sample number is GRD-95-44X.)

Based on a smaller sample set of ten surface grabs, Norton (2001) calculated an arithmetic mean of 29.3 mg/kg, very close to that computed for the comprehensive dataset discussed in the foregoing.

Mercury was detected in the two upstream reference samples from Flannagan Pond at 0.3 mg/kg, and in the reference sample from Sandy Pond at 0.62 mg/kg. Based on this limited comparison, it appears that mercury is significantly elevated in shallow Grove Pond sediment relative to the upstream reference ponds, particularly in the area of Tannery Cove. It is emphasized again that the central tendency estimates for the comprehensive data are based on detections only, and are therefore biased high with respect to the pond-wide mercury concentrations.

Sampling of deep (>1 ft) sediment in Grove Pond is relatively sparse (Figure 5-23), and Hg was detected in seven of ten samples. Although there is a suggestion of higher detections in the Tannery Cove area, this conclusion is tentative because of the paucity of samples across the majority of the pond. The arithmetic mean of the seven detections is 27.1 mg/kg; the geometric mean is 3.44 mg/kg. These central-tendency estimates are strongly influenced by a few high detections in the Tannery Cove area, and are not representative of the pond as a whole. The maximum concentration detected in deep sediment is 150 mg/kg (GRD-95-26X) at a depth of 3 ft. The next highest detection is also in Tannery Cove, 28 mg/kg (GRD-95-27X) at a depth of 5 ft. It is noted that the area off the former tannery site is known to have been subject to filling, so that "deep" (>1 ft) sediment was likely closer to the sediment – water interface in relatively recent years.

5.6.1.2 Plow Shop Pond

The distribution of mercury detections in shallow (0-1 ft) sediment samples from Plow Shop Pond is shown in Figure 5-24. No spatial pattern is apparent; the higher detections are scattered widely across the pond. The maximum detection is 250 mg/kg, in a sample from the northwest portion of the pond near the opening of the outlet cove. Mercury was not detected in only 6 of 102 samples in the database for shallow sediment. The arithmetic mean of the 96 detections is 28.9 mg/kg; the geometric mean is 7.45 mg/kg (Fig. 5-22). These measures of central tendency are both higher than those for shallow sediment in Grove Pond (25.8 mg/kg and 4.06mg/kg, respectively).

For comparison, Norton (2001) reports an arithmetic average for Hg in 10 shallow-sediment grab samples of 18.4 mg/kg, about 36% lower than the result for the larger database considered here. Mercury was detected in the three samples from the two upstream reference ponds at 0.3, 0.3, and 0.62 mg/kg. Based on this limited characterization of the reference ponds, it appears that Hg is elevated in shallow sediment in Plow Shop Pond relative to upstream areas.

Mercury in deep sediment samples (>1 ft) from Plow Shop Pond is also elevated relative to available reference values. 26 of 78 available deep sediment analyses are non-detect. The arithmetic mean of the 52 detections is 16.2 mg/kg; the geometric mean is 2.53 mg/kg. There is some suggestion that the higher concentrations of mercury in deep Plow Shop Pond sediment tend to be found along the western shore (Figure 5-25). The maximum detection of Hg in deep sediment is 220 mg/kg, obtained for sample PSPC19 at a depth of 3.5 ft, located in Red Cove. Other relatively high detections in deep sediment are at PSPC15 at a depth of 1.5 ft (117 mg/kg), at the mouth of the northwest outlet cove, and at PSPC17 at a depth of 1.5 ft (96 mg/kg), near the northwest shore, south of PSPC15. Note again that it is possible that sedimentation along the western shore, perhaps due to erosion of the steep slope between Shepley's Hill Landfill and the pond, may have buried sediment formerly closer to the sediment – water interface.

5.6.2 Transport Processes

Mercury occurs in three oxidation states. Hg(0) is present either as a liquid at room temperature or as a gas (95% of Hg in the atmosphere is Hg^0). Mercury can exist in soil and water in a number of Hg(I) and Hg(II) species. The dominant process controlling Hg transport appears to be the sorption of nonvolatile forms to particulates in soil or in the water column and subsequent deposition in sediments (Hurley, et al., 1991). Mercury is transformed by biotic and abiotic oxidation and reduction reactions, bioconversion of inorganic and organic forms, and photolysis. Inorganic Hg can be methylated by aerobic and anaerobic microorganisms. In the pH range 4-9 and in the presence of sulfide, Hg^{+2} will precipitate as a sulfide with low solubility (approximately 10^{-15} to 10^{-16} micrograms per liter (ATSDR 1999)). If pH is low and Hg concentrations sufficiently high, methylHg is favored, and has greater bioavailability than inorganic forms.

5.6.3 Conceptual Model

Mercury is clearly elevated in Grove Pond and Plow Shop Pond shallow sediment (geometric mean concentrations of ~4 and ~ 7 parts per million, respectively; maximum detections of 420 and 250 ppm, respectively) relative to the upstream ponds (detections of a few tenths of a ppm). In Grove Pond, there is a clear spatial association of the higher Hg detections with the former tannery site in the northwest portion (Fig. 5-21). Upstream of the tannery (i.e., in the eastern portion of Grove Pond), Hg detections are typically <1 mg/kg. In the vicinity of Tannery Cove, concentrations rise to tens to hundreds of mg/kg. This spatial distribution is strongly suggestive of a source of mercury at the historical tannery, consistent with its possible use as a fungicide in hide storage or use in the tanning process itself. Mercury salts used in the leather tanning industry include mercuric (Hg(II)) chloride, mercury oxide (yellow), mercury oxide (red), ammoniated mercuric chloride, mercurous chloride calomel, and mercuric iodide.

In addition to the spatial association of elevated Hg with the tannery site, it is noted that mercury concentrations in the sediment of both ponds are strongly correlated with chromium concentrations (Fig. 5-20). Because most of the chromium present in the ponds system unequivocally originates at the former tannery, its association with mercury is strongly suggestive of an identical source.

Plow Shop Pond exhibits mercury that is distributed quite ubiquitously (Fig. 5-24). The pond is downstream of the tannery site via a culvert under the railroad causeway. The geometric mean concentration of Hg in shallow sediment is higher (~7 mg/kg) in Plow Shop Pond than in Grove Pond (~4 mg/kg), and there are few non-detects in the database. Thus, it is apparent that, once Hg was released to the environment from the tannery site, transport processes acted to distribute it relatively uniformly across Plow Shop Pond. This is a somewhat unexpected result, as familiar transport processes for metals might be expected to show a "swath" of elevated Hg from the culvert to the outlet in the northwest cove. If, for example, Hg were sorbed onto clastic particles (e.g., on ferric oxyhydroxide grain coatings), its downstream distribution would be controlled by sediment transport processes. However, it is difficult to reconcile the ubiquitous Hg in Plow Shop Pond with expected patterns of clastic sediment transport, particularly given that the pond is a very low-energy environment. For this reason, it is speculated that organic matter in the ponds may have played a significant role in enhancing the mobility of mercury.

Although Hg has received a great deal of attention in recent years in New England because of concern for the impact of atmospheric fallout from emissions from coal burning in the Midwest, it appears that the Hg in Grove and Plow Shop Ponds is dominated by one or more other sources. Kamman, et al. (2004) recently surveyed numerous lakes across Vermont and New Hampshire for mercury accumulation. They found total mercury in sediment at concentrations ranging from 0.07 to 0.62 mg/kg, with an arithmetic mean of 0.24 mg/kg, based on 129 samples. These results are about two orders of magnitude lower than the concentrations observed in Grove and Plow Shop Ponds, suggesting that regional atmospheric deposition has contributed only a very small fraction of the Hg observed.

5.7 Lead

5.7.1 Distribution

For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	**Pb Concentration (mg/kg)**
Flannagan Pond	200 and 120
Sandy Pond	280
Spectacle Pond*	5.7
Grove Pond*	~8 - 14
Plow Shop Pond*	~1 - 12

*Norton (2001) "background"

5.7.1.1 Grove Pond

The distribution of lead detections in shallow (0-1 ft) sediment samples from Grove Pond is shown in Figure 5-26. Lead detections are ubiquitous across the pond, but the highest detections appear to cluster in the northwestern portion of the pond, known as Tannery Cove. The maximum detection is 1760 mg/kg, in a sample in this area (GRD-95-31X). The second highest detection is also in Tannery Cove, at 1600 mg/kg (GP15). Lead was not detected in only 2 of 142 samples in the database for shallow sediment. The arithmetic mean of the 140 detections is 271 mg/kg; the geometric mean is 133 mg/kg (Fig. 5-27).

Based on a smaller sample set of ten surface grabs, Norton (2001) calculated an arithmetic mean of 249 mg/kg, very close to that computed for the comprehensive dataset discussed in the foregoing.

Lead was detected in the two upstream reference samples from Flannagan Pond at 120 and 200 mg/kg, and in the reference sample from Sandy Pond at 280 mg/kg. Based on this limited comparison, it appears that lead is not greatly elevated overall in shallow Grove Pond sediment relative to the upstream reference ponds. However, a number of samples in the vicinity of Tannery Cove show concentrations above 1000 mg/kg, approximately an order of magnitude higher than the upstream reference values.

Sampling of deep (>1 ft) sediment in Grove Pond is relatively sparse (Figure 5-28), and Pb was detected in 10 of 16 samples. Although there is a suggestion of higher detections in the Tannery Cove area, this conclusion is tentative because of the paucity of samples across the majority of the pond. The arithmetic mean of the ten detections is 122 mg/kg; the geometric mean is 19.3 mg/kg. These central-tendency estimates are strongly influenced by a few high detections in the Tannery Cove area, and are not representative of the pond as a whole. The maximum concentration detected in deep sediment is 150 mg/kg (GRD-95-26X) at a depth of 3 ft. The next highest detection is also in Tannery Cove, 28 mg/kg (GRD-95-27X) at a depth of 5 ft. It is noted that the area off the former tannery site is known to have been subject to filling; "deep" (>1 ft) sediment was likely closer to the sediment – water interface prior to this activity.

There are relatively few samples from >1 ft in Grove Pond, so it is difficult to generalize. However, it is noteworthy that, pond-wide, there are 38% NDs for Pb in the deeper sediment, while the shallow sediment showed only <2% NDs. The very high- concentration samples in the deeper sediment are exclusively in the Tannery Cove area, and are believed to be due to burial of once-surficial sediments by material pushed into the pond during historical filling operations in the cove. (The high Pb is accompanied by high Cr, which is believed to be an unequivocal indicator of tannery impact.)

5.7.1.2 Plow Shop Pond

The distribution of lead detections in shallow (0-1 ft) sediment samples from Plow Shop Pond is shown in Figure 5-29. Lead detections are ubiquitous across the pond, although there appears to be a cluster of more elevated concentrations in the vicinity of the former Railroad Roundhouse on the southeast shore. The maximum detection is 1210 mg/kg, in a sample in this area (RHD-94-02X). (Note that the Figure 5-29 displays a concentration of 1214 mg/kg at a location that falls on shore northeast of the outlet cove in the northwest portion of the pond. This point is deemed suspect, and is not included in the summary statistics discussed here.) The second highest detection is also immediately offshore from the former Railroad Roundhouse, at 1000 mg/kg (SHD-94-09X). Lead was not detected in only 9 of 108 samples in the database for shallow sediment. The arithmetic mean of the 99 detections is 188 mg/kg; the geometric mean is 101 mg/kg (Fig. 5-27).

Based on a smaller sample set of ten surface grabs, Norton (2001) calculated an arithmetic mean of 229 mg/kg, about 22% higher than the mean computed for the larger data set considered in the foregoing.

Lead was detected in the two upstream reference samples from Flannagan Pond at 120 and 200 mg/kg, and in the reference sample from Sandy Pond at 280 mg/kg. Based on this limited comparison, it appears that lead is not greatly elevated overall in shallow Plow Shop Pond sediment relative to the upstream reference ponds. However, a number of samples in the vicinity of the former Railroad Roundhouse show concentrations of the order of 1000 mg/kg, significantly higher than the upstream reference values.

Sampling of deep (>1 ft) sediment in Plow Shop Pond (Fig. 5-30) is much more extensive than that in Grove Pond (Figure 5-n). Lead was detected in 66 of 79 samples. Concentrations overall are significantly lower than those detected in shallow Plow Shop Pond (0-1 ft) sediment. The bubble map suggests that Pb concentrations in deep sediment tend to be higher along the western shore of the pond, similar to the observations made for cadmium (Sec. 5.4.3) and chromium (Sec. 5.5.3). The arithmetic mean of the 66 detections is 33.2 mg/kg; the geometric mean is 11.4 mg/kg. The maximum concentration detected in deep sediment is 260 mg/kg, near the mouth of the outlet cove in the northwest portion of the pond (PSPC15).

5.7.2 Transport Processes

Lead occurs as Pb^{2+} and in a variety of Pb(II) solids (e.g., PbO, $PbCO_3$, $PbCl_2$, $PbSO_4$, PbS). Like other metal cations, lead sorbs onto oxyhydroxides of Fe, Al, and Mn. This gives lead a strong affinity for solid particulates, and limits its mobility in solution. In an aqueous environment, lead will eventually precipitate as an oxide or a sulfide, depending upon local redox conditions. Lead can also be biomethylated, increasing its mobility and volatility.

5.7.3 Conceptual Model

Lead is ubiquitous in shallow (<1 ft) sediment in both Grove and Plow Shop Ponds. Less than 5% of the 250 shallow sediment samples analyzed from the two ponds showed no detectable lead. The geometric mean concentrations for Grove and Plow Shop Ponds are 133 mg/kg and 101 mg/kg, respectively. Detections of the order of 100 mg/kg are scattered widely across both ponds. An area of distinctly higher lead concentrations appears to lie adjacent to the former tannery site in Grove Pond, with several samples showing concentrations greater than 1000 mg/kg. Another area of somewhat elevated Pb is in Plow Shop Pond adjacent to the former Railroad Roundhouse site, where concentrations in several samples are again of the order of 1000 mg/kg.

Deep sediment (>1 ft) in both ponds shows a greater prevalence of non-detects for lead than does shallow sediment, and the arithmetic and geometric means of all lead detections in deep sediment are significantly lower than those for shallow sediment.

Lead has been exploited historically for a number of its physical and chemical properties.
Lead carbonate, or "white lead," sublimed lead, and other lead compounds were at one time widely used paint pigments. It is not known whether or not any historical industries around the ponds (e.g., the Nashoba Mordant and Dye Company) manufactured or handled lead-containing pigments. Note that there is no indication in the spatial distribution of lead detected in sediment that a significant source was or is present in the industrial area on the north shore of Plow Shop Pond. Lead compounds (e.g., Pb-sulfate and Pb-stearate) are used as stabilizers in plastics, particularly those used for electrical insulation. Soluble salts of lead (e.g., nitrates, acetates) have been used as insecticides. Lead arsenate was a widely used pesticide from the late 19th century through the first half of the 20th century. This pesticide was applied heavily in apple orchards, which cover significant acreage within the drainage basin for the ponds. However, due to its relative immobility once adsorbed onto soil particles, there is little evidence that significant quantities of lead were transported from fruit-growing areas to the ponds. Lead anti-knock compounds were added to motor fuels starting in the 1920s, and their use in the United States peaked in the 1970s, when the advent of the catalytic converter and environmental concerns for lead emissions resulted in their phase-out. During the period of leaded gasoline use, large quantities of lead were released to the atmosphere in vehicle exhaust, spread widely by air circulation, and ultimately deposited to soil and surface water. Particulates washed into surface water through soil erosion and storm water runoff added further to lead accumulation in sediment.

The ubiquitous concentrations of lead of the order of 100 mg/kg found across both Grove and Plow Shop Ponds can likely be ascribed to atmospheric deposition and deposition from stormwater runoff from developed areas. Analyses on three samples collected from the upstream reference ponds, which were not subject to the industrial activities prevalent around Grove and Plow Shop Ponds, yielded concentrations in the same range as the arithmetic and geometric means for shallow sediment from the latter, 100 to 300 mg/kg. Elevated Pb at concentrations of the order of 1000 mg/kg in the vicinity of the former tannery site suggests that lead arsenate pesticides likely were used in historic tannery operations. This is further supported by the association of the high lead concentrations in this area with correspondingly high arsenic (presumably from the pesticide compounds) and chromium (believed to be a reliable "tracer" for tannery impacts). Elevated lead, again at concentrations of the order of 1000 mg/kg, found adjacent to the former Railroad Roundhouse site may be derived from babbitt, a Pb alloy used to manufacture journal bearings for railroad cars. Babbitt formulated for this application is typically composed of lead, antimony, tin, and copper. Speculation that babbitt was handled on the site is supported by results from the Railroad Roundhouse Supplemental Site Investigation that found elevated levels of Sb (maximum 1400 mg/kg), Cu (maximum 6900 mg/kg), Pb (maximum 7100 mg/kg), and Sn (maximum 140 mg/kg) in onshore soil, interpreted to be "maintenance by-products" (ABB, 1995). Because antimony and tin are not on the standard Target Analyte List for sediment, correlations between sediment Pb and Sb or Sn cannot be sought to test this hypothesis. However, a strong correlation between Cu and Pb is found for sediment samples collected in Plow Shop Pond adjacent to the Railroad Roundhouse (Fig. 5-31).

In summary, the majority of the lead detections in shallow (0-1 ft) sediment in both ponds, typically of the order of 100 mg/kg, are likely due to ubiquitous atmospheric deposition and stormwater runoff, with the ultimate source being emissions from leaded fuels. This source has diminished sharply in the past 20 years due to the phase-out of leaded gasoline. Lead is further elevated in the northwest portion of Grove Pond, where concentrations of the order of 1000 mg/kg can likely be ascribed to the waste stream from the historic tannery, which appears to have applied lead arsenate pesticides. Similarly, lead is locally elevated in sediment adjacent to the former Railroad Roundhouse, where maintenance activities yielded metallic debris. Lead was detected in deep (>1 ft) sediment along the southern and western shores of Plow Shop Pond. As noted in the discussions of Cd (Sec. 5.4.3) and Cr (Sec. 5.5.3), this pattern may be a consequence of more rapid sedimentation along these portions of the shoreline due to steep slopes and exposed soils. Under these circumstances, sediment that was shallow (0-1 ft) in the later half of the 20th century may now be categorized as "deep" (>1 ft).

5.8 Manganese

Although there has been no suggestion that Mn represents anthropogenic inputs to the ponds, a brief overview of its occurrence in sediment is given here for completeness. The discussion is based on sediment sampling and analyses performed by EPA in 2004 and 2005 only.

5.8.1 Distribution

The following table summarizes sediment analyses for manganse available as reference values (Sec. 5.1) to which to compare results from Grove and Plow Shop Ponds.

Reference Area	Mn Concentration (mg/kg)
Flannagan Pond	460 and 690
Sandy Pond	980
Spectacle Pond*	380
Grove Pond*	~220 - 825
Plow Shop Pond*	~290 - 942

*Norton (2001) "background"

Manganese was detected in all EPA 2004/2005 sediment samples. Results for shallow (0-1 ft) Grove Pond sediment range from 70 to 1800 mg/kg, with a geometric mean of 818 mg/kg. Shallow (0-1 ft) Plow Shop Pond results are notably higher, in the range 130 to 34,000 mg/kg, and with a geometric mean of 1410 mg/kg. Deep (>1 ft) Plow Shop Pond sediment exhibits lower Mn concentrations than does the shallow sediment, ranging from 31 to 4500 mg/kg, with a geometric mean of 475 mg/kg. The geometric mean Mn concentrations observed for shallow (0-1 ft) Grove Pond and deep (>1 ft) Plow Shop Pond are comparable to the reference concentrations cited in the above table. The geometric mean for shallow (0-1 ft) Plow Shop Pond sediment (1410 mg/kg) is higher than the reference values.

5.8.2 Transport Processes

Manganese is a commonly occurring element in the earth's crust, with an average concentration of 950 mg/kg (Krauskopf, 1967). In solution, manganese behavior is generally similar to that of iron. Aqueous species contain Mn in the +2, +3, and +4 oxidation states and, like iron, Mn may precipitate as oxide, sulfide, and carbonate solid phases. At pH values between 4 and 9, the range found in most natural waters, Mn requires a higher oxidation potential than Fe to oxidize Mn^{+2} to Mn^{+4}, and the kinetics of abiotic Mn oxidation are generally much slower than for Fe (Stumm and Morgan, 1996).

Although not as toxic as the other elements of interest in this study, manganese may cause unpleasant taste and odor in drinking water, and may clog pipes through formation of scale precipitated by Mn-oxidizing bacteria.

5.8.3 Conceptual Model

The high concentrations of Mn in shallow sediment in Plow Shop Pond are predominantly in the southwestern portion. The maximum detected (34,000 mg/kg) is in Red Cove, and a sequence of near-shore sediment samples collected by EPA along the western margin of the pond shows a systematic decrease in Mn to the north, reaching 240 mg/kg near the outlet weir. This pattern mimics closely the distribution of iron and arsenic concentrations in Plow Shop Pond sediment, suggesting that similar processes control the distribution. It is known that groundwater approaching Red Cove shows relatively high concentrations of manganese. EPA profile sampling of groundwater in two direct-push borings adjacent to Red Cove conducted in July 2004 yielded Mn concentrations in filtered samples from 0.39 to 6.2 mg/L, with an arithmetic mean of 1.8 mg/L (see table, sec. 5.10.3). Dissolved iron in the same samples was also elevated, with a mean concentration of 34 mg/L. ORP reported for these samples falls in a relatively narrow range, from -134 to -78 mV. It is concluded that the relatively high Mn concentrations detected in sediments in the southwestern portion of Plow Shop Pond have accumulated from low-ORP, high-Fe, high-Mn groundwater that discharges to the surface water in this area, in a process similar to that controlling arsenic (cf, Sec. 5.3.3).

5.9 Vanadium

The human-health risk assessment (sec. 6.0; Appendix C) identifies vanadium in fish tissue in Plow Shop Pond and as a risk driver (i.e., Hazard Quotient greater than one). Although there has been no suggestion that this element represents anthropogenic inputs to the ponds, a brief overview of its occurrence in sediment is given here for completeness. The discussion is based on sediment sampling and analyses performed by EPA in 2004 and 2005 only.

5.9.1 Distribution

The following table summarizes sediment analyses for vanadium available as reference values (Sec. 5.1) to which to compare results from Grove and Plow Shop Ponds.

Reference Area	V Concentration (mg/kg)
Flannagan Pond	39 and 21
Sandy Pond	49
Spectacle Pond*	not analyzed
Grove Pond*	not analyzed
Plow Shop Pond*	not analyzed

*Norton (2001) "background"

Vanadium was detected in 17 of 17 shallow (0-1 ft) sediment samples from Grove Pond analyzed by EPA in 2004/2005. Concentrations range from 22 to 140 mg/kg, with a geometric mean of 57.3 mg/kg. Three reference samples collected in upstream Flannagan and Sandy Ponds showed V in the range 21 to 49 mg/kg, indicating no evidence of a source or sources local to Grove Pond. Similarly, vanadium was detected in 15 of 20 shallow sediment samples collected by EPA in Plow Shop Pond, ranging from 7.1 to 80 mg/kg, with a geometric mean of 31.8 mg/kg. Again, the similarities in concentrations detected in the upstream ponds, Grove Pond, and Plow Shop Pond suggest no local inputs. Deep (>1 ft) sediment from Plow Shop Pond exhibited detectable V in 20 of 24 samples, in the range 3.2 to 51 mg/kg, with a geometric mean of 11.2 mg/kg. There are no readily available reference values for V in deep sediment for comparison.

5.9.2 Transport Processes

The aqueous speciation of vanadium is dependent on both pH and ORP. Under oxidizing conditions and at near-neutral pH, the most abundant species are those of V(V), $VO_2(OH)_2^-$ and $H_2VO_4^-$. At lower pH and/or under more reducing conditions, concentrations of other, positively-charged, vanadium species increase and are either approximately equal to, or exceed, those of V(V). These include V(III) as $V(OH)_2^+$, and V(IV) as $VOOH^+$ and VO^{+2}. Because vanadium may be present in sediment pore waters in nearly equal proportions as positively- and negatively-charged species, it may bind to both negatively- and positively-charged sites on hydrous ferric oxide surfaces.

Vanadium is naturally occurring, at an average concentration of 135 mg/kg in the earth's crust (Krauskopf, 1967). This element is used in the production of steel and other metal alloys, and in small amounts in manufacture of plastics, ceramics, and rubber. In addition to V mobilized in the environment by surficial weathering processes, V is also released into the atmosphere by combustion of fuel oil and coal.

5.9.3 Conceptual Model

There are no indications in the limited vanadium data reviewed (i.e., EPA 2004/2005 analyses only) of local sources to the ponds. Observed geometric means are comparable to reference values obtained from upstream ponds not impacted by historical activities surrounding Grove and Plow Shop Ponds. It is likely that most of the vanadium mass found in pond sediment is of natural origin, and is present at concentrations reflecting regional lithologies and long-term geological and geochemical transport processes.

5.10 Groundwater Hydrology

This section addresses briefly the interaction of the ponds with adjacent groundwater. This aspect of the hydrology of the system is of particular importance with respect to arsenic detected in pond sediment, which is interpreted to have accumulated primarily from discharging groundwater (see sec. 5.3.3).

Available data to constrain the groundwater hydrology on the scale of Grove and Plow Shop Ponds and the surrounding watershed are limited. The present discussion is restricted to two portions of the system that have been characterized in greater detail. The first is the area in the vicinity of the Town of Ayer water supply wells on the southeast shore of Grove Pond. This area was studied to evaluate the source of arsenic detected in raw (untreated) water produced at the supply wells (Gannett Fleming, 2002). The second area for which there are extensive hydrological data is the domain west of Plow Shop Pond, in the vicinity of Shepley's Hill Landfill (SHL). Groundwater associated with SHL is characterized periodically under a Long-Term Monitoring Plan (Stone and Webster, 1996), and under the Performance Monitoring Plan for the SHL extraction, treatment, and discharge (ETD) system (CH2MHill, 2005). In addition, EPA collected water-level data for an expanded suite of wells in the SHL area in November 2004. Finally, EPA and Gannett Fleming mapped near-shore shallow sediment temperatures along the southern and western shoreline of Plow Shop Pond in March 2004 and April 2005.

5.10.1 Grove Pond / Town of Ayer Wellfield

A Zone II (i.e., the domain contributing to production under extended drought conditions) delineation was conducted for the Town of Ayer Grove Pond wellfield in 1992 (CDM, 1993).

Water levels were recorded regionally both before and during a pumping test at the supply wells. The interpreted groundwater potential surface indicated flow under ambient conditions (no pumping) converging on the eastern portion of the pond from the south, east, and north. The interpreted water levels under pumping conditions suggested relatively local drawdown, with a significant component of the production coming from induced infiltration from Grove Pond. More detailed characterization of the hydrostratigraphy in the neighborhood of the supply wells (Gannett Fleming, 2002) showed that interaction of the wells with the surface water is inhibited by relatively low-conductivity material overlying the screened interval. For this reason, it was concluded that the capture zone for the supply wells extends farther beneath the pond than inferred in the 1992 Zone II study, and induced infiltration is weak. It is likely that a significant fraction of the deeper groundwater flow that converges on the eastern portion of Grove Pond joins a regional subsurface flow toward the WNW, generally following the surface water drainage from Grove Pond to Plow Shop Pond to Nonacoicus Brook to the Nashua River.

Little is known about groundwater – surface water interaction around the majority of the Grove Pond perimeter. It is likely that shallow groundwater discharges to the pond, particularly in the eastern (upgradient) portion. The areas in proximity to the Ayer and Devens wellfields on the south shore are exceptions. Weak induced recharge was found immediately offshore of the Ayer wells when pumping (Gannett Fleming, 2002), and it is likely that the same occurs adjacent to the Devens Grove Pond wellfield. In the western (downgradient) portion of the pond, it is possible that the surface water recharges groundwater, which generally flows to the west and/or northwest.

5.10.2 Plow Shop Pond

Groundwater elevations have been characterized more extensively adjacent to Plow Shop Pond than for areas surrounding Grove Pond because of monitoring associated with Shepley's Hill Landfill (SHL). The landfill lies to the west and southwest of Plow Shop Pond, and monitoring well coverage is extensive. EPA performed a synoptic round of water-level gauging on November 15, 2004, in a large suite of wells along the western and southwestern shore of the pond, as well as in wells farther to the south, west, and northwest. Figure 5-32 shows an interpreted potential surface based on the data collected from shallow overburden wells. Reference elevations were adopted from CH2MHill's survey of existing and new wells (CH2MHill, 2006). Water levels in three wells (SHP-99-29X, SHM-93-01A, and SHL-10) were referenced to older survey results available through the Army GIS database.

An important feature characterizing the interaction of groundwater with Plow Shop Pond is the point where the 217 ft msl groundwater contour intersects the shore immediately north of the southwestern embayment known as Red Cove. The surface water elevation was not measured at the time of the November 2004 groundwater gauging event. However, a staff gauge was installed subsequently near the outlet dam, and has shown very stable pond elevations in six rounds of data collection in August and September 2005 and in March 2006 (CH2MHill, 2005, 2006). The surface water elevation in these six events varied from 217.0 to 217.2 ft msl, indicating that the weir imposes strong control on the pond level. It is therefore reasonable to assume that the surface elevation of Plow Shop Pond was approximately 217 ft msl at the time of the November 2004 groundwater gauging event. The point at which the 217 ft msl groundwater equipotential intersects the pond shoreline is then interpreted as the "hinge" for the pond. Groundwater levels to the south of this point are higher than the surface water, and groundwater discharges to the pond. Groundwater levels to the north of this point are lower than the pond level, and surface water recharges groundwater. Performance monitoring data for the SHL ETD system (CH2MHill, 2005, 2006) confirm that the hinge was in the vicinity of piezometer N2-P2 in August and September 2005. However, the hinge appears to have shifted somewhat to the north, in the vicinity of SHP-01-37X, in March 2006, perhaps due to seasonally elevated groundwater levels in spring.

Independent evidence for the zone of groundwater discharge to the south and southwest shore of Plow Shop Pond is found in nearshore temperature data. In winter and spring, the surface water is colder than adjacent shallow groundwater. Where relatively warm groundwater discharges to the pond, the sediment temperature is elevated relative to the surface water. On March 8, 2004, Gannett Fleming personnel walked the shore of Plow Shop Pond, observed the distribution of surface ice and open water, and measured sediment temperatures with a thermocouple probe where possible. Most of the pond retained thick ice cover at this time, but intermittent patches of open water up to several feet wide perpendicular to the shore and up to tens of feet long parallel to shore were observed. In the two prominent coves on the south and southwest shore, large areas of water were open. Many of these open patches showed accumulations of reddish orange flocculant, interpreted to be hydrous ferric oxide precipitated from reducing groundwater that discharges to the oxidizing surface water environment.

Figure 5-33 shows temperatures measured at 1 ft depth below the water-sediment interface in March 2004; locations are approximate. Sediment temperatures were recorded in the range 1.8 to 10.3 °C. Temperatures varied systematically near the two coves, increasing from the outer (pondward) opening toward the inner (landward) end. The maximum temperature reached in the southern cove (west of the Railroad Roundhouse site) was 10.3 °C; that in Red Cove was 8.5 °C. This pattern is consistent with the focusing of groundwater discharge due to refraction of flowlines approaching the coves. At locations where the thermocouple probe could be inserted to greater depth, temperatures were consistently higher with depth. In addition, where the temperatures at 1 ft bgs were highest (e.g., at the end of the southern cove), the vertical variation in temperature was smallest. These observations are again consistent with discharge of relatively warm groundwater to the pond, with the warmest sediment temperatures corresponding to loci of maximum advective heat transport. Northward of the northernmost point shown on Figure 5-33, the ice was in contact with the shore, and no patches of open water were observed. This change in conditions north of Red Cove is consistent with the location of the hinge interpreted from the adjacent groundwater levels (Figure 5-32). North of the northernmost observed patch of open water, cold pond water recharges groundwater, and the nearshore surface temperature remains at or below freezing.

EPA collected similar data in April 2005 (Figure 5-34). At that time, the entire pond was free of ice. Temperatures at 1 ft below the water-sediment interface were recorded with the thermocouple probe, and sample locations were recorded with a hand-held GPS unit. Data were recorded along the shoreline from a point north of Red Cove to the outlet weir. The data show a gradient from temperatures around 16 °C north of Red Cove to about 13 °C approaching the outlet. This observation is consistent with increasing recharge by surface water from south to north. The vertical hydraulic gradient increases in magnitude from zero at the hinge to a maximum near the outlet weir, and the flux of cold surface water under winter/spring conditions correspondingly increases from south to north.

5.10.3 Arsenic Flux to Red Cove

The hydraulic data discussed in the foregoing paragraphs indicate that shallow groundwater discharges to Red Cove. Arsenic concentrations are very high in shallow (0-1 ft) sediment in this area, with a maximum observed of 6800 mg/kg. It is of interest to estimate the total arsenic mass flux to Red Cove in groundwater to compare to the observed mass presently sequestered in sediment.

The observed head change from SHP-01-38A (217.5 ft msl) to the pond (217.1 ft msl) on August 1, 2005 (CH2MHill, 2006) was 0.4 ft (0.12 m). The distance from that monitoring well to the pond shore is approximately 50 ft (15 m), giving a horizontal gradient of 0.008. CH2MHill (2006) estimated the hydraulic conductivity of the fine sands in the neighborhood of the extraction wells to be 45 ft/d (14 m/d), the average of two determinations. This is in agreement with the overburden conductivity assigned in a calibrated numerical model by Harding (2003). These values give a groundwater flux ("Darcy velocity") of q = 0.36 ft/d (0.11 m/d).

EPA profiled groundwater chemistry in two direct-push borings flanking Red Cove in July 2004. One boring was sampled from 3 to 23.5 ft bgs, a section 20.5 ft (6.2 m) thick; the second was sampled from 4 to 37 ft bgs, a section 33 ft (10 m) thick. The average overburden thickness profiled was 27 ft (8.2 m). The perimeter of Red Cove is approximately 400 ft (120 m). The cross-sectional area across which overburden groundwater approaches the cove is then A = 11,000 ft^2 (990 m^2). The total volume flow rate to the cove is Q = q x A = 3800 ft^3/d (110 m^3/d = $1.1\text{x}10^5$ L/d). Twelve groundwater samples were collected across these two sections; the geometric mean (filtered) arsenic concentration detected was $\bar{c}$ = 0.43 mg/L. The total mass flux to the cove is then estimated to be J = Q x $\bar{c}$ = $4.7\text{x}10^4$ mg/d = 17 kg/yr.
A simple test can be carried out to determine whether or not the foregoing estimate of the total arsenic mass flux to Red Cove reconciles with the concentrations of arsenic observed in sediment. The cove is roughly 100 ft by 200 ft in areal extent, i.e., covering about $2.0\text{x}10^4$ ft^2 ($1.9\text{x}10^3$ m^2). If most of the arsenic brought to the surface by discharging groundwater

accumulates in the uppermost 1 ft (0.30 m) of sediment, the corresponding volume of sediment is $2.0x10^4$ ft^3 (570 m^3). Assume that the (dry) bulk density of the sediment is 1800 kg/m^3, giving a total sediment mass of $1.0x10^6$ kg. According to the estimate for the total mass flux in the previous paragraph, over a period of 100 years, about 1700 kg of arsenic would be discharged to Red Cove. Averaged over the total shallow (<1 ft) sediment mass, this yields a concentration of 1700 mg/kg, which is typical of the observed concentrations in this area. Analytical results for the twelve shallow sediment samples in Red cove shown in Figure 5-4 show As concentrations ranging from 310 to 6800 mg/kg, with a geometric mean of 1400 mg/kg.

It is emphasized that the foregoing is only an order-of-magnitude argument. It involves numerous assumptions and estimates of many parameters, resulting in considerable uncertainty. Nevertheless, the order-of-magnitude agreement between the estimated arsenic mass available from groundwater and the observed arsenic mass in sediment supports the plausibility of the proposed mechanism of accumulation.

It has been suggested that arsenic mobility is controlled by iron (sec. 5.3.3), in which case it might be expected that iron concentrations in Red Cove sediment and in adjacent groundwater are related in a fashion similar to that discussed in the foregoing paragraphs for arsenic. This can be tested readily by rescaling the calculation. The ratio of the geometric mean Fe concentration to the geometric mean As concentration for the ten (filtered) groundwater samples collected from the EPA direct-push borings is 70 (see table below). Therefore, the expected iron concentration in Red Cove sediment, under the same assumptions made for the arsenic calculation, is 70 x 1700 = 120,000 mg/kg. Observed iron concentrations in eleven Red Cove sediment samples (Fig. 5-4; PS2 was not analyzed for Fe) range from 25,500 to 410,000 mg/kg, with a geometric mean of 130,000 mg/kg. Therefore, the mass of iron present in Red Cove sediment is consistent in an order-of-magnitude sense with the cumulative flux of dissolved iron in discharging groundwater over a time scale of the order of 100 years.

It has also been proposed (sec. 5.8.3) that manganese accumulates in sediment from reducing groundwater that discharges to Red Cove. Again, an order-of-magnitude test is possible by estimating the mass flux of manganese in groundwater to the cove, and comparing to the mass present in shallow sediment. The ratio of geometric mean Mn to geometric mean As from the ten (filtered) direct-push groundwater samples is 3.0 (see table below). The expected manganese concentration in sediment is then 3.0 x 1700 = 5100 mg/kg. For comparison, the observed Mn concentrations in four shallow sediment samples collected in Red Cove by EPA in 2004/2005 (PSP06, PSPC13, PSPC14, and PSPC19) range from 1500 to 34,000 mg/kg, with a geometric mean of 4000 mg/kg. This agreement supports the conclusion that manganese, like iron and arsenic, accumulates in Red Cove sediment from discharging groundwater. The reducing groundwater encounters more oxidizing conditions as it approaches the sediment/water interface, and the iron and manganese precipitate to solid phases.

In principle, a similar test could be made for accumulation of other trace metals, including Cd, Cr, Pb, and V, whose mobility in groundwater also is strongly influenced by iron. This would provide an estimate of possible accumulation from groundwater to compare to sediment concentrations. In the cases of Cd, Cr, and Pb, it is concluded in the foregoing sections that much of the mass present is likely due to anthropogenic inputs from historical activities surrounding the ponds. These conclusions would be supported by a determination that accumulation of Cd, Cr, and Pb from discharging groundwater yields sediment concentrations much lower than observed. In practice, this calculation cannot be carried out, because all analyses for Cd and Pb performed on filtered samples from the direct-push groundwater profiling at Red Cove failed to detect these elements at a detection limit of 0.2 µg/L. Chromium was detected in one of ten filtered samples at 0.52 µg/L, just above the detection limit of 0.5 µg/L. Vanadium was not detected in filtered groundwater samples from the direct-push borings.

Analytical results for groundwater sampled from direct-push borings, Red Cove

interval ft bgs	As unfiltered µg/L	As (F) filtered µg/L	Fe unfiltered µg/L	Fe (F) filtered µg/L	Mn unfiltered µg/L	Mn (F) filtered µg/L
boring RC1						
3-5	260	270	33000	37000	650	740
8-10	650	NA	23000	NA	450	NA
13-15	740	NA	26000	NA	520	NA
18-20	650	690	23000	20000	1000	970
21.5-23.5	580	630	17000	19000	1700	2400
boring RC2						
4-6	130	140	15000	19000	940	1200
9-11	600	650	45000	72000	1400	2200
14-16	370	390	51000	55000	970	660
19-21	270	310	32000	37000	490	540
24-26	330	370	28000	31000	380	390
30-32	550	710	34000	30000	2400	2700
35-37	530	610	21000	16000	5400	6200
arith. mean	470	480	29000	34000	1400	1800
geom. mean	430	430	27000	30000	980	1300

6.0 HUMAN HEALTH RISK ASSESSMENT

A Human Health Risk Assessment (HHRA) has been performed and is included as Appendix C. This section of this ESI report contains a summary of the human health risk assessment for Grove and Plow Shop Ponds. The objective of the HHRA is to provide a quantitative estimate of risk posed to humans potentially exposed to Grove Pond and Plow Shop Pond. To assess potential public health risks, three major aspects of chemical contamination and exposure must be considered: 1) the presence of chemicals with toxic characteristics; 2) the existence of pathways by which human receptors may contact site-related chemicals; and 3) the presence of human receptors. The absence of any of these three aspects would result in an incomplete exposure pathway and an absence of quantifiable risk.

The HHRA consists of five major components: Hazard Identification, Exposure Assessment, Dose-Response Assessment, Risk Characterization and Uncertainty Analysis. Tables 5-1 and 5-2 and Appendix C of the HHRA present summaries of the cancer risks and noncancer hazard indices which exceeded EPA acceptance criteria for each receptor evaluated in the risk assessment. These tables identify the chemicals which are driving the risks and present the hazard indices segregated by target organ. Section 6.0 of the HHRA presents the uncertainties associated with the risk evaluations and presents rationale for consideration in determining the chemicals of concern for this site which may require further evaluation and action.

6.1 Human Health Risk Assessment Conclusions

Grove Pond

The human health risk assessment evaluated risks to four receptors: a recreational adult, recreational child, subsistence angler adult and subsistence angler child. Media considered in the recreational receptor evaluations included sediment, surface water and fish tissue. The only medium used in the evaluation of risks to the subsistence angler receptors was fish tissue. For Grove Pond, the carcinogenic risk threshold of 1E-4 was equaled for the recreational adult and recreational child. This threshold was exceeded for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers, defined as chemicals with risks in excess of 1E-6, for the recreational receptors included arsenic (surface water and sediment), PAHs (sediment), phthalates (surface water) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment), mercury (fish tissue), and PCBs (fish tissue).

Carcinogenic risk drivers for the subsistence angler included PCBs, DDD and DDE. Noncarcinogenic risk drivers included mercury and PCBs.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children but were exceeded for the subsistence angler child receptor.

Plow Shop Pond

Human health risk assessment results for Plow Shop Pond were similar to those from Grove Pond. For Plow Shop Pond, the carcinogenic risk threshold of 1E-4 was exceeded for the recreational adult and recreational child. This threshold was equaled for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

> Carcinogenic risk drivers for the recreational receptors included arsenic (surface water, sediment and fish tissue), PAHs (sediment) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment, surface water), chromium (sediment), and mercury (fish tissue).

Carcinogenic risk drivers for the subsistence angler included arsenic and DDD. Noncarcinogenic risk drivers included mercury and vanadium.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children. Lead was not a chemical of potential concern in fish tissue from Plow Shop Pond.

Evaluation of Results

This section compares human health risk results to the findings of the fate and transport/environmental chemistry evaluation performed for this study. Of this risk drivers identified in the human health risk assessment, the metals arsenic, chromium, mercury and lead appear to be related to identifiable sources within Grove and Plow Shop Ponds including area-wide groundwater for arsenic. Vanadium has not been identified as a metal with clear Pond-related sources. Possibly, elevated levels of these metal, and associated risks, occur as a result of mobilization of naturally occurring metals by reduced groundwater that enters the ponds from the direction of Shepley's Hill Landfill or other areas.

Organic constituents identified as risk drivers include PAHs, PCBs and DDT breakdown products. While these chemicals are clearly anthropogenically-related, multiple sources for these chemicals appear applicable. Sources may have included upstream contamination, stormwater runoff, atmospheric deposition as well as contributions from the former tannery and railroad roundhouse located on the shores of these ponds. Currently, it is not possible to clearly attribute the contribution levels of these sources to the concentrations observed. However, it does not appear that groundwater is a contributor of organic constituents to the Ponds.

7.0 ECOLIGICAL RISK ASSESSMENT

A Baseline Ecological Risk Assessment (BERA) has been performed and is included in Appendix D. This section of this ESI report contains a summary of the BERA which was conducted to provide a quantitative estimate of risk posed to ecological receptors potentially exposed to Grove Pond and Plow Shop Pond media. This BERA, which incorporates data from 1991 to 2005 collected through several different investigations in the ponds, was conducted to support the ESI.

The conceptual site model (CSM) for Grove Pond and Plow Shop Pond identifies exposure pathways from chemicals in pond sediment, surface water, and biota to aquatic organisms and semi-aquatic wildlife foraging in the pond. Assessment and measurement endpoints were selected based on the CSM. Assessment endpoints represent the ecological resources in the ponds that are to be protected. Measurement endpoints represent measurable ecological characteristics that are evaluated to determine if the assessment endpoints are met.

The assessment endpoints for the receptor groups in the ponds are as follows:

- Protection of the long-term health of water column invertebrate populations sublethal and lethal acute toxic effects of chemicals in surface water.

- Protection of benthic macroinvertebrate communities from sublethal and lethal acute toxic effects of chemicals in sediments.

- Protection of the long-term health of local fish populations from sublethal and lethal toxic effects of chemicals in surface waters.

- Protection of omnivorous mammals and birds, piscivorous mammals and birds, and insectivorous birds foraging in the pond, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction.

The measurement endpoints used in this BERA to determine risk are the following:

- Comparison of surface water and sediment concentration data to literature benchmarks protective of aquatic biota.

- Surface water chronic toxicity testing using sensitive freshwater invertebrate and fish species.

- Sediment toxicity testing using sensitive invertebrate species.

- Comparison of aquatic invertebrate and fish tissue residue levels against literature Critical Body Residues (CBRs).

- Food chain modeling to estimate a daily intake for wildlife receptors foraging in the ponds; compared the daily intake with literature toxicity reference values (TRV) to calculate a hazard quotient (HQ).

A Weight of Evidence (WOE) approach was used to interpret the various findings of the risk assessment. A WOE score was given to each measurement endpoint "low-medium" to "high", depending on the strength of the link between the measurement endpoint and its associated assessment endpoint. The WOE score was evaluated along with the estimation of risk for each assessment endpoint in a risk integration step. This risk integration step allowed a determination of the potential for and significance of risk to the various assessment endpoints.

Exposure units are defined in ecological risk assessment to provide an estimate of the area of exposure for a given ecological receptor and to determine how to organize the analytical data. The exposure units for this BERA were 1) Grove Pond, 2) Plow Shop Pond, and 3) Flannagan Pond, the reference site.

The HQ method was used to determine risk for ecological receptors foraging in the ponds. An HQ was calculated for each chemical of potential concern (COPC) by dividing an estimated or measured exposure or dose by a corresponding benchmark or toxicity value. Hazard quotients were determined for benchmarks comparisons, CBR comparisons, and food chain modeling. The HQ method was not used to determine risk in toxicity tests, however, which relied on statistical analyses instead.

Where applicable, potential risk to ecological receptors was determined for the background EU, using the same methods used to determine risk to Grove Pond and Plow Shop Pond receptors. A residual risk (RR) was calculated by dividing the site HQ by the background HQ. If the RR was greater than one, risk for a given COPC could not be attributed to background conditions.

7.1 RISK FINDINGS

The results of the risk characterization are summarized in Table 7-1 (Grove Pond) and Table 7-2 (Plow Shop Pond).

TABLE 7-1 Summary of Ecological Risks for Grove Pond

Target Receptor Group	Measurement Endpoints (Lines of Evidence)								Integrated Risk Interpretation
	Published Benchmarks		Laboratory Toxicity Testing		Tissue Residue Analyses		Food Chain Modeling		
	WOE	Risk	WOE	Risk	WOE	Risk	WOE	Risk	
water column invertebrates	L-M	L	M	N		ND		ND	Low risk; no unacceptable risk.
Fish	L-M	L	M	N	M-H	L		ND	Low risk; no unacceptable risk.
benthic invertebrates	L-M	H	M-H	M	M-H	L		ND	Medium risk; unacceptable risk.
omnivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk
piscivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.
carnivorous birds		ND		ND		ND	M-H	M	Medium risk
piscivorous birds		ND		ND		ND	M-H	N	No unacceptable risk.
insectivorous birds		ND		ND		ND	M-H	M	Medium risk; Unacceptable risk unlikely.

Shaded cells indicate that the measurement endpoint was not applicable to the assessment endpoint
WOE = weight of evidence
N=No significant risk identified; L-M = low-medium; M-H = medium-high; H = high
ND = not determined

TABLE 7-2 Summary of Ecological Risks for Plow Shop Pond

Target Receptor Group	Measurement Endpoints (Lines of Evidence)								Integrated Risk Interpretation
	Published Benchmarks		Laboratory Toxicity Testing		Tissue Residue Analyses		Food Chain Modeling		
	WOE	Risk	WOE	Risk	WOE	Risk	WOE	Risk	
water column invertebrates	L-M	L	M	N		ND		ND	Low risk; no unacceptable risk.
Fish	L-M	L	M	N	M-H	L		ND	Low risk; no unacceptable risk.
benthic invertebrates	L-M	H	M-H	M	M-H	L		ND	Medium risk; unacceptable risk.
omnivorous mammals		ND		ND		ND	M-H	H	High risk; unacceptable risk
piscivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.
carnivorous birds		ND		ND		ND	M-H	L	Low risk
piscivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.
insectivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.

Shaded cells indicate that the measurement endpoint was not applicable to the assessment endpoint
WOE = weight of evidence
N=No significant risk identified; L-M = low-medium; M-H = medium-high; H = high
ND = not determined

7.1.1 Water column invertebrate community

Potential risk to water column invertebrates based on each measurement endpoint was determined to be the following:

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons for Grove Pond and Plow Shop Pond revealed low potential risk to surface water invertebrates.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium weight. The results of the toxicity tests with *Ceriodaphnia dubia* revealed no significant toxicity for surface water invertebrates in Grove Pond and Plow Shop Pond.

Integrating these two lines of evidence, it is unlikely that surface water invertebrates in either of the ponds experience unacceptable risk from exposure to COPCs.

7.1.2 Benthic macroinvertebrate community

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons revealed high potential risk to benthic invertebrates in Grove Pond and Plow Shop Pond.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium-high weight. Laboratory toxicity testing of three Grove Pond sediment samples using two benthic invertebrate species resulted in significant growth reductions (but no mortality) in two of the three samples. Testing of 11 Plow Shop Pond sediment samples using the same two species resulted in significant mortality and growth reductions in one sample, and significant growth reductions (but no mortality) in five additional samples.

C. CBR comparison: The CBR comparison measurement endpoint was given a medium-high weight. The results of the CBR comparison suggested low risk to benthic invertebrates from accumulated COPC in Grove Pond and Plow Shop Pond.

Integrating these results, it was concluded that toxicity testing and the CBR comparisons carried greater weight than did the comparisons to sediment benchmarks. Therefore, while benchmark exceedances alone suggested potential high risk to benthic invertebrates in both ponds, subsequent lines of evidence indicated that the exceedances did not equate to high risk. The three lines of evidence suggest that benthic invertebrates in Grove Pond were likely to experience medium risk due to potential growth reduction. Benthic invertebrates in Plow Shop Ponds were

likely to experience medium risk due to reduced survival at one location and reduced growth at several other locations in the pond

7.1.3 Fish community

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons for Grove Pond and Plow Shop Pond revealed low potential risk to fish.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium weight. The results of the toxicity tests with *Pimephales promelas* revealed no significant toxicity for fish in Grove Pond and Plow Shop Pond.

C. CBR comparison: The CBR comparison measurement endpoint was given a medium-high weight. The results for the CBR comparison in six fish species collected from Grove Pond indicated that three metals (copper, lead, and zinc) exceeded their LOAEL level by small margins (highest average HQ [hazard quotient]$_{LOAEL}$ = 2.9 for copper in bullhead). These results suggested the presence of low risk to fish in Grove Pond.

The results for the CBR comparison in four fish species collected from Plow Shop Pond, indicated that only copper exceeded its LOAEL level by a small margin (highest average HQ_{LOAEL} = 2.5 in bullhead). These results also suggested the presence of low risk to fish in Plow Shop Pond.Integrating these three lines of evidence, the fish community in either Grove Pond or Plow Shop Ponds is not likely to be at substantial risk from exposure to COPCs. The low risk identified by the CBR comparisons would not have community-level impacts because all the LOAEL exceedances were low, and both copper and zinc are under physiological control.

7.1.4 Omnivorous mammals

The raccoon was the target receptor representing omnivorous mammals feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific total daily doses (TDD) for comparison to mammalian Toxicity Reference Values (TRVs). Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated it unlikely that omnivorous mammals would experience unacceptable risk from foraging in Grove Pond. However, the potential for high risk was identified for omnivorous mammals foraging in Plow Shop Pond, mainly because of the incidental ingestion of arsenic in pond sediments. There was significant uncertainty associated with this finding, as discussed below.

7.1.5 Piscivorous mammals

The mink was the target receptor representing piscivorous mammals feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to mammalian TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicate that it was not likely that piscivorous mammals would experience unacceptable risk from foraging in Grove Pond or Plow Shop Pond.

7.1.6 Carnivorous birds

The black-crowned night heron was the target receptor representing carnivorous birds feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated the potential for medium risk to carnivorous birds foraging in Grove Pond and low risk in Plow Shop Pond, mainly owing to the incidental ingestion of chromium in pond sediments. There was significant uncertainty associated with this finding, as discussed below.

7.1.7 Piscivorous birds

The kingfisher was the target receptor representing piscivorous birds feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated that it was not likely that piscivorous birds foraging in Grove Pond would experience unacceptable risk. However, the potential for medium risk was identified for piscivorous birds foraging in Plow Shop Pond, owing to excessive levels of methyl mercury in fish.

7.1.8 Insectivorous birds

The tree swallow was the target receptor representing insectivorous birds feeding at the Site. Only one LOE was used to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. The COPC concentrations used in modeling were based on the analysis of tree swallow stomach contents. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated that insectivorous birds foraging in Grove Pond and Plow Shop Pond would likely experience medium risk, mainly because of the presence of high chromium levels in stomach contents.

7.2 MAJOR UNCERTAINTIES

The potential for high risk from sediment ingestion was identified for omnivorous mammals (represented by the raccoon) and carnivorous birds (represented by the black-crowned night heron) foraging in the two Site ponds. Several major uncertainties are associated with these risk estimates.

Firstly, unacceptable risk was identified for the raccoon in Plow Shop Pond because of incidental ingestion of arsenic in sediment. The sediment uptake assumption for the raccoon (9% of the diet) was taken from EPA (1993). Because the value was based on conditions different from those in the ponds, there is uncertainty in the accuracy of this value for Grove Pond and Plow Shop raccoons, or other omnivorous mammals. This uncertainty is particularly important because the unacceptable risk concluded for the raccoon in Plow Shop Pond is due to incidental ingestion of arsenic in sediment. Therefore, the risk assumption relies entirely on the sediment intake assumption for this species.

Similarly, the sediment uptake assumption for the black-crowned night heron (2% of the diet) was based on a best professional judgment. There were no measured values for similar species that could have been used with more confidence; EPA (1993) lists an uptake for other aquatic birds at 2%. This uncertainty is particularly important because the risk concluded for the black-crowned night heron in both ponds is due to incidental ingestion of chromium in sediment. Therefore, the risk assumption relies entirely on the sediment intake assumption for this species. For both the raccoon and the night heron, uncertainty is associated with the sediment ingestion rates for another reason. The estimated sediment uptake percentages are potentially overestimated because of the dense vegetative mat that exists throughout the ponds. Because this mat may act as a barrier between sediment and biota, wildlife receptors may have limited direct exposure to sediment substrate. The incidental ingestion assumptions (e.g., 0.09 for the raccoon and 0.02 for the black-crowned night heron potentially overestimate risk from this pathway.

8.0 SUMMARY AND CONCLUSIONS

8.1 Conceptual Model

The ESI presents a broad overview of each of five key elements that have been identified in this and previous studies as potential concerns from a risk perspective. Data for each of these five elements are presented in Section 5.0 in map view in order to identify qualitatively any spatial patterns that suggest localized sources and/or transport pathways. Maps are presented for each pond, and for two depth intervals: 0-1 ft and >1 ft below the sediment/water interface. In addition, histograms are presented for the log-transformed concentrations of each element for the shallow interval (0-1 ft). These plots give a visual impression of the central tendency (geometric mean) and variability (geometric standard deviation) of each element at the pond-wide scale. Elements that exhibit marked departures from log-normal distributions, as well as wide scatter, are suggestive of releases at one or more point sources, superimposed on the ambient distribution.

A*rsenic.* Arsenic is detected in Grove Pond shallow (0-1 ft) sediment at concentrations typically a few tens to a few hundred mg/kg. The geometric mean is 49.8 mg/kg, which is within the range of available reference concentrations determined for the upstream ponds. Characterization of deeper sediment (>1 ft) is limited, but suggests somewhat lower concentrations overall, with a geometric mean of 25.0 mg/kg. A few samples from the northwest portion of the pond (Tannery Cove) exhibit higher concentrations, of the order of 1000 mg/kg, found in both shallow and deep sediment. It is inferred that the widespread arsenic in Grove Pond sediment has accumulated from discharging groundwater, which is known to exhibit elevated arsenic where reducing conditions prevail. In the vicinity of the former tannery, scattered detections at higher concentrations suggest that there may have been local releases associated with historical activities, possibly use of arsenical pesticides.

Plow Shop Pond also exhibits widespread arsenic detections, typically of the order of a few hundred mg/kg, notably higher than the overall concentrations found in Grove Pond. The geometric mean for shallow sediment (0-1 ft) in Plow Shop Pond is 217 mg/kg. Deep sediment (>1 ft) overall is lower in As, with a geometric mean of 35.0 mg/kg. Arsenic detections in shallow sediment are significantly elevated relative to the mean in the southwest portion of the pond (Red Cove), with a maximum detection of 6800 mg/kg. It is inferred that the preponderance of the arsenic detected in Plow Shop Pond sediment is again the result of accumulation from high-As groundwater. Groundwater approaching Red Cove has been shown to exhibit reducing conditions and high dissolved iron and arsenic. The extent to which Shepley's Hill Landfill is responsible for creating or exacerbating the reducing conditions that mobilize arsenic is unknown. When this groundwater discharges to the pond, and encounters oxidizing conditions near the sediment/water interface, hydrous ferric oxide phases precipitate, and adsorb arsenic. This process is evidenced by the abundant reddish orange floc for which Red Cove is named. Sediment As concentrations decrease to the north, approaching the hinge line, north of which the pond recharges groundwater.

Cadmium. Cadmium is detected in both Grove Pond and Plow Shop Pond shallow (0-1 ft) sediment, typically at concentrations ranging from non-detect to a few tens of mg/kg. The geometric mean concentrations for detections in both ponds are nearly identical, 13.2 mg/kg (Grove Pond) and 13.5 mg/kg (Plow Shop Pond). Analyses on deep samples (>1 ft) revealed very few detections. It is inferred that the widespread Cd in shallow sediment likely accumulated from atmospheric deposition and stormwater runoff. Although there are a few potential industrial users of cadmium adjacent to the ponds, there is no suggestion of a localized source in the spatial distribution of concentration. Scattered detections at higher concentrations may be the result of local releases. The maximum detection across both ponds is an isolated value of 730 mg/kg, adjacent to the railroad causeway at the west end of Grove Pond. This may reflect a local, sporadic source. The higher concentrations along the southern and western shores of Plow Shop Pond may result from erosion and deposition of adjacent soils. Clastic sedimentation rates may be higher in this area because of the relatively steep topography and bare ground on the shore. The detection of Cd in the deep (>1 ft) sediment in the same area is consistent with this scenario.

Chromium. Chromium exhibits a very wide range of concentrations in shallow (0-1 ft) sediment in Grove Pond, from non-detect to 52,000 mg/kg. Over the majority of the pond, concentrations are typically of the order of tens of mg/kg, while the high values are found in the vicinity of the former tannery in the northwest portion (Tannery Cove). The geometric mean, which is strongly influenced by the very high concentrations in the Tannery Cove area, is 489 mg/kg, significantly higher than the reference values from the upstream ponds (14-27 mg/kg). The spatial association with the former tannery is clear and consistent with the known use of chromium in the tanning process, and historical waste disposal practices. Few samples have been collected from deep (>1 ft) sediment in Grove Pond, so that generalizations with respect to the spatial distribution of Cr are not possible. There are, however, detections of very high Cr in deep sediment in Tannery Cove (maximum 44,000 mg/kg). It is believed that these "deep" sediments were deposited in the 19^{th} and/or 20^{th} centuries, and subsequently buried by rapid sedimentation due to infilling of the cove.

Plow Shop Pond also shows very high levels of chromium in shallow sediment, with a geometric mean of 908 mg/kg, and a maximum detection of 37,800 mg/kg. In contrast to Grove Pond, high chromium detections in Plow Shop Pond are widespread, and show no obvious spatial pattern of accumulation. While it seems apparent that the ultimate source of the majority of the chromium in Plow Shop Pond sediment is the historic tannery, it is not clear what processes have acted to distribute Cr ubiquitously. It is speculated that organic complexation and/or uptake of Cr by aquatic vegetation may have served to spread chromium relatively uniformly across the pond.

Mercury. Mercury is detected in shallow (0-1 ft) sediment across most of Grove Pond at concentrations of the order of a few mg/kg, but is clearly elevated in the northwest portion of the pond (Tannery Cove). The geometric mean concentration is 4.06 mg/kg, and the maximum (Tannery Cove) is 420 mg/kg. There are relatively few samples of the deep (>1 ft) sediment in Grove Pond, but these are consistent with the shallow results; the maximum detection is 150 mg/kg, in Tannery Cove. The clear spatial association with the former tannery implicates that facility as the source of the preponderance of mercury in pond sediment. Although no records of use have been found, mercury salts were used in tanning, and mercury was used commonly as a fungicide, as well.

Mercury concentrations in Plow Shop Pond shallow (0-1 ft) sediment are higher overall than in Grove Pond, with a geometric mean of 7.45 mg/kg. Mercury is widely dispersed in Plow Shop Pond, with no apparent spatial pattern. As discussed for chromium, it is speculated that organic complexation and/or uptake of Hg by aquatic plants may play a role in the apparently high mobility of mercury within Plow Shop Pond. It is interesting to note that the ratio of the geometric mean concentration for 96 detections of Hg in Plow Shop Pond to that for 96 detections in Grove Pond shallow sediment is 1.83, while the ratio of geometric means for 102 detections of Cr in Plow Shop Pond and 135 detections in Grove Pond is 1.86. The similarity in spatial distribution, as well as in the overall partitioning of contaminant mass between the two ponds, is strongly suggestive that the mercury and chromium in the system share the same source (i.e., the historic tannery) and are controlled by similar transport processes.

Lead. Lead is detected ubiquitously in shallow sediment across Grove Pond, with a geometric mean of 133 mg/kg. Relatively few deep sediment samples were collected in Grove Pond, but the limited data suggest significantly lower concentrations in the sediments >1 ft below the sediment/water interface; Pb was detected in this interval in 10 of 16 samples, with a geometric mean of 19.3 mg/kg. Lead was detected in three shallow samples from the upstream reference ponds in the range 120 to 280 mg/kg, similar to the geometric mean for Grove Pond. Widespread lead concentrations of the order of 100 mg/kg are inferred to result from atmospheric deposition and stormwater runoff, ultimately tracing back to historic vehicle emissions in the era of leaded fuels. A few anomalously high concentrations of lead were detected in the vicinity of Tannery Cove (maximum 1760 mg/kg), and suggest possible use of lead arsenate pesticides at the facility. Note, for example, that the highest lead detection in deep (>1 ft) sediment was found in a sample from Tannery Cove, with Pb at 1000 mg/kg, and accompanied in the same sample by As at 1300 mg/kg and Cr at 44,000 mg/kg. The association with As suggests a possible origin in lead arsenate, and the association with very high Cr seems to implicate the tannery's waste stream. It is noted again that "deep" sediment (>1 ft) in tannery cove likely was surficial sediment in recent decades, but was buried by rapid sedimentation associated with infilling of the cove.

Lead in shallow sediment in Plow Shop Pond is again ubiquitous, with typical concentrations of the order of 100 mg/kg. The geometric mean is 101 mg/kg. Sample coverage for deep sediment in Plow Shop Pond is much more extensive than in Grove Pond. The geometric mean for 66 detections (out of 79 samples) is 11.4 mg/kg, an order of magnitude lower than in the shallow interval. This is again consistent with the interpretation that the preponderance of lead in Plow Shop Pond originates from atmospheric deposition and stormwater inputs. A few detections of lead at concentrations of the order of 1000 mg/kg were found adjacent to the former Railroad

Roundhouse site on the southeast shore. Detection of elevated Pb, Sb, Cu, and Sn in onshore soils at the Roundhouse site are suggestive of a source in babbitt, an alloy used in railroad-car bearings. A strong correlation of Pb and Cu in nearshore sediment samples further supports this interpretation.

8.2 Human Health Risk Assessment

Grove Pond

The human health risk assessment evaluated risks to four receptors: a recreational adult, recreational child, subsistence angler adult and subsistence angler child. Media considered in the recreational receptor evaluations included sediment, surface water and fish tissue. The only medium used in the evaluation of risks to the subsistence angler receptors was fish tissue. For Grove Pond, the carcinogenic risk threshold of 1E-4 was equaled for the recreational adult and recreational child. This threshold was exceeded for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers, defined as chemicals with risks in excess of 1E-6, for the recreational receptors included arsenic (surface water and sediment), PAHs (sediment), phthalates (surface water) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment), manganese (surface water), mercury (fish tissue), and PCBs (fish tissue).

Carcinogenic risk drivers for the subsistence angler included PCBs, DDD and DDE. Noncarcinogenic risk drivers included mercury and PCBs.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children but were exceeded for the subsistence angler child receptor.

Plow Shop Pond

Human health risk assessment results for Plow Shop Pond were similar to those from Grove Pond. For Plow Shop Pond, the carcinogenic risk threshold of 1E-4 was exceeded for the recreational adult and recreational child. This threshold was equaled for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers for the recreational receptors included arsenic (surface water, sediment and fish tissue), PAHs (sediment) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment, surface water), chromium (sediment), and mercury (fish tissue).

Carcinogenic risk drivers for the subsistence angler included arsenic and DDD. Noncarcinogenic risk drivers included mercury and vanadium.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children. Lead was not a chemical of potential concern in fish tissue from Plow Shop Pond.

Evaluation of Results

This section compares human health risk results to the findings of the fate and transport/environmental chemistry evaluation performed for this study. Of this risk drivers identified in the human health risk assessment, the metals arsenic, chromium, mercury and lead appear to be related to identifiable sources within Grove and Plow Shop Ponds including area-wide groundwater for arsenic. Vanadium and manganese have not been identified as metals with clear Pond-related sources. There has been no suggestion that either Mn or V sediment concentrations represent anthropogenic inputs to the ponds. It is concluded that the relatively high Mn concentrations found in the southwestern portion of Plow Shop Pond have accumulated from low-ORP, high-Fe, high-Mn groundwater that discharges to the surface water in this area, in a process similar to that controlling arsenic (cf, Sec. 5.3.3). It is likely that most of the vanadium mass found in pond sediment is of natural origin, and is present at concentrations reflecting regional lithologies and long-term geological and geochemical transport processes. Possibly, elevated levels of these metals, and associated risks, occur as a result of mobilization of naturally occurring metals by reduced groundwater that enters the ponds from the direction of Shepley's Hill Landfill or other areas.

Organic constituents identified as risk drivers include PAHs, PCBs and DDT breakdown products. While these chemicals are clearly anthropogenically-related, multiple sources for these chemicals appear applicable. Sources may have included upstream contamination, stormwater runoff, atmospheric deposition as well as contributions from the former tannery and railroad roundhouse located on the shores of these ponds. Currently, it is not possible to clearly attribute the contribution levels of these sources to the concentrations observed. However, it does not appear that groundwater is a contributor of organic constituents to the Ponds. Relatively few analyses for organics in groundwater surrounding the ponds have been performed. The available data are not sufficient to determine the extent of organic contamination of pond sediments from groundwater.

8.3 Ecological Risk Assessment

The BERA identified unacceptable risk for two receptor groups in Grove Pond and three receptor groups in Plow Shop Pond. The chemicals that were identified as risk drivers are arsenic, chromium, and PAHs.

In Grove Pond, risk to benthic invertebrates was found to be unacceptable based on results of toxicity tests, although no specific risk driver could be identified. Risk to carnivorous birds was also found to be unacceptable in Grove Pond. The risk estimate was driven by the incidental ingestion of chromium in sediment.

In Plow Shop Pond, risk to benthic invertebrates, omnivorous mammals, and carnivorous birds was found to be unacceptable. For benthic invertebrates, unacceptable risk was attributed to PAHs in the vicinity of the Railroad Roundhouse. In other areas (e.g., the western shore), a COC driving toxicity could not be identified with confidence. Risk to omnivorous mammals was attributed primarily to the incidental ingestion of arsenic in sediment. Risk to carnivorous birds was attributed primarily to the incidental ingestion of chromium in sediment. While risk to omnivorous mammals and carnivorous birds was found to be unacceptable, there is significant uncertainty associated with risk determination for both receptor groups. This is primarily because of the uncertainty associated with the amount of sediment that the representative species were assumed to ingest.

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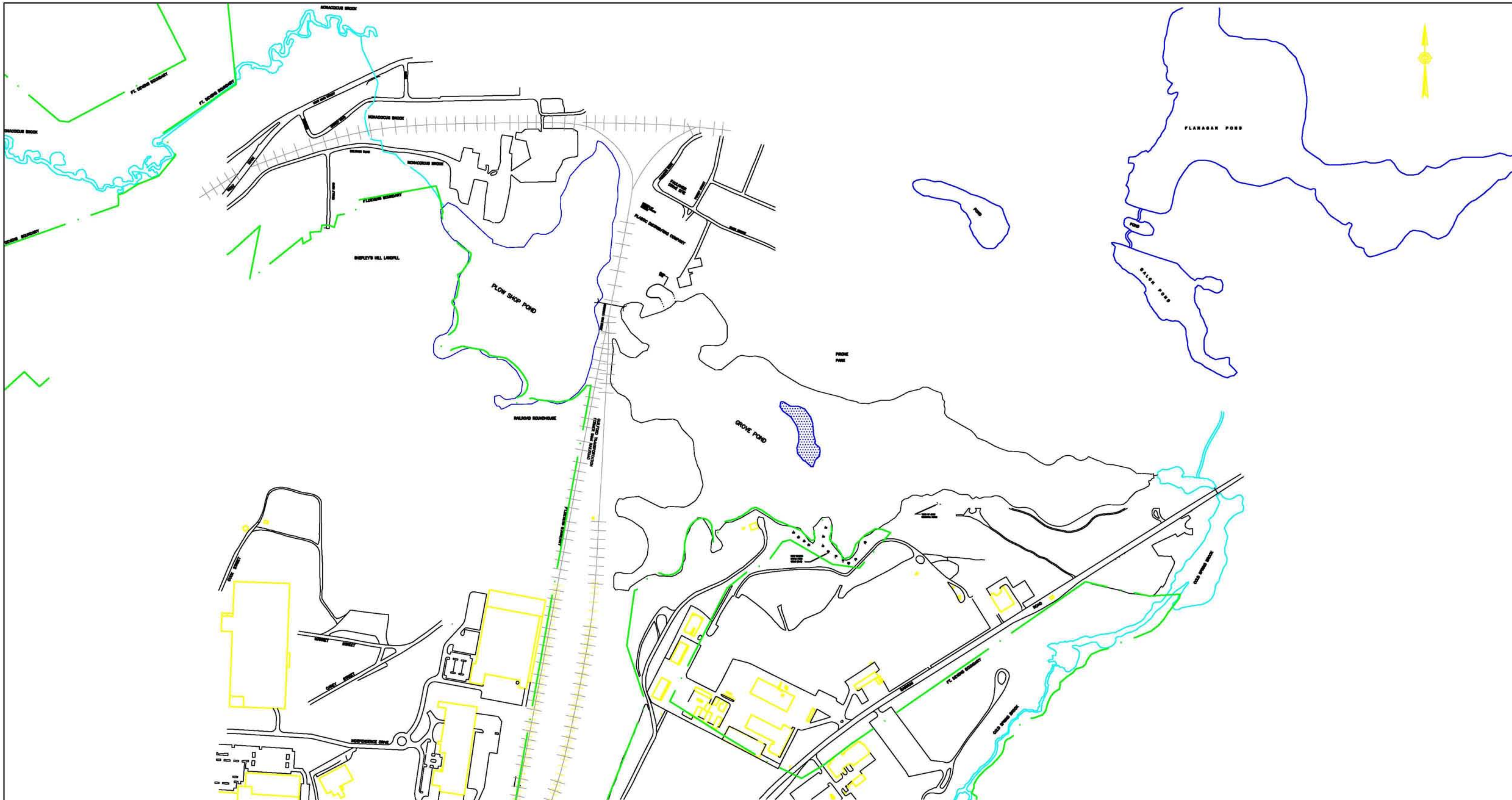
FIGURES



GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

GENERAL NOTES:

1. Base map was originated from the MassGIS database system.
2. Sample locations are approximate only and have not been instrument surveyed by Gannett Fleming, Inc.

REGION 1
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BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

SITE LOCATION MAP

FIGURE NO.
2–1

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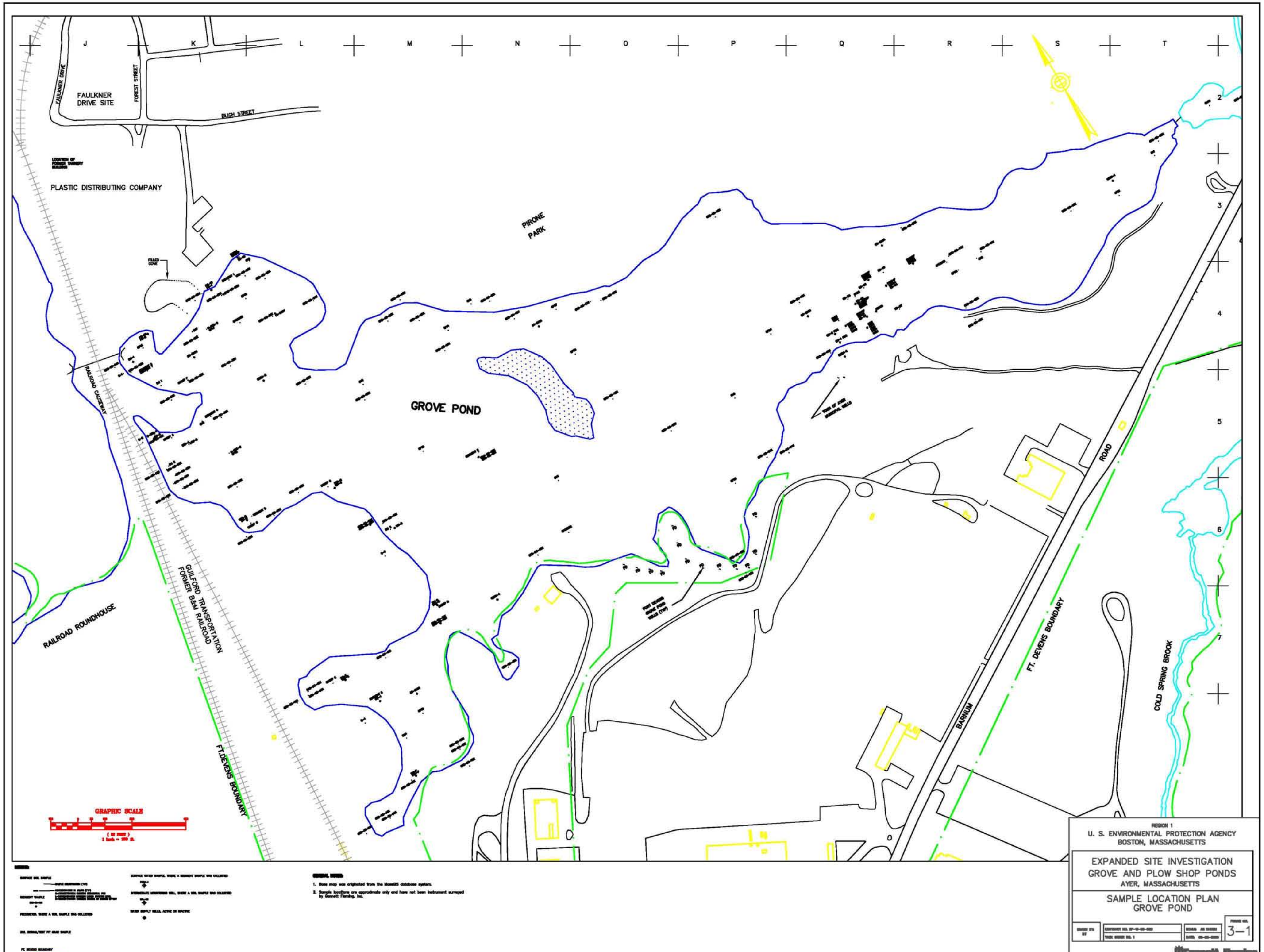

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FAULKNER DRIVE
FAULKNER DRIVE SITE
FOREST STREET
BLIGH STREET
PLASTIC DISTRIBUTING COMPANY
PIRONE PARK
FILLED COVE
GROVE POND
RAILROAD CAUSEWAY
RAILROAD ROUNDHOUSE
GUILFORD TRANSPORTATION FORMER B&M RAILROAD
FT.DEVENS BOUNDARY
FT. DEVENS BOUNDARY
BARNUM ROAD
COLD SPRING BROOK
GRAPHIC SCALE
General Notes:
1. Base map was originated from the MassGIS database system.
2. Sample locations are approximate only and have not been instrument surveyed by Gannett Fleming, Inc.
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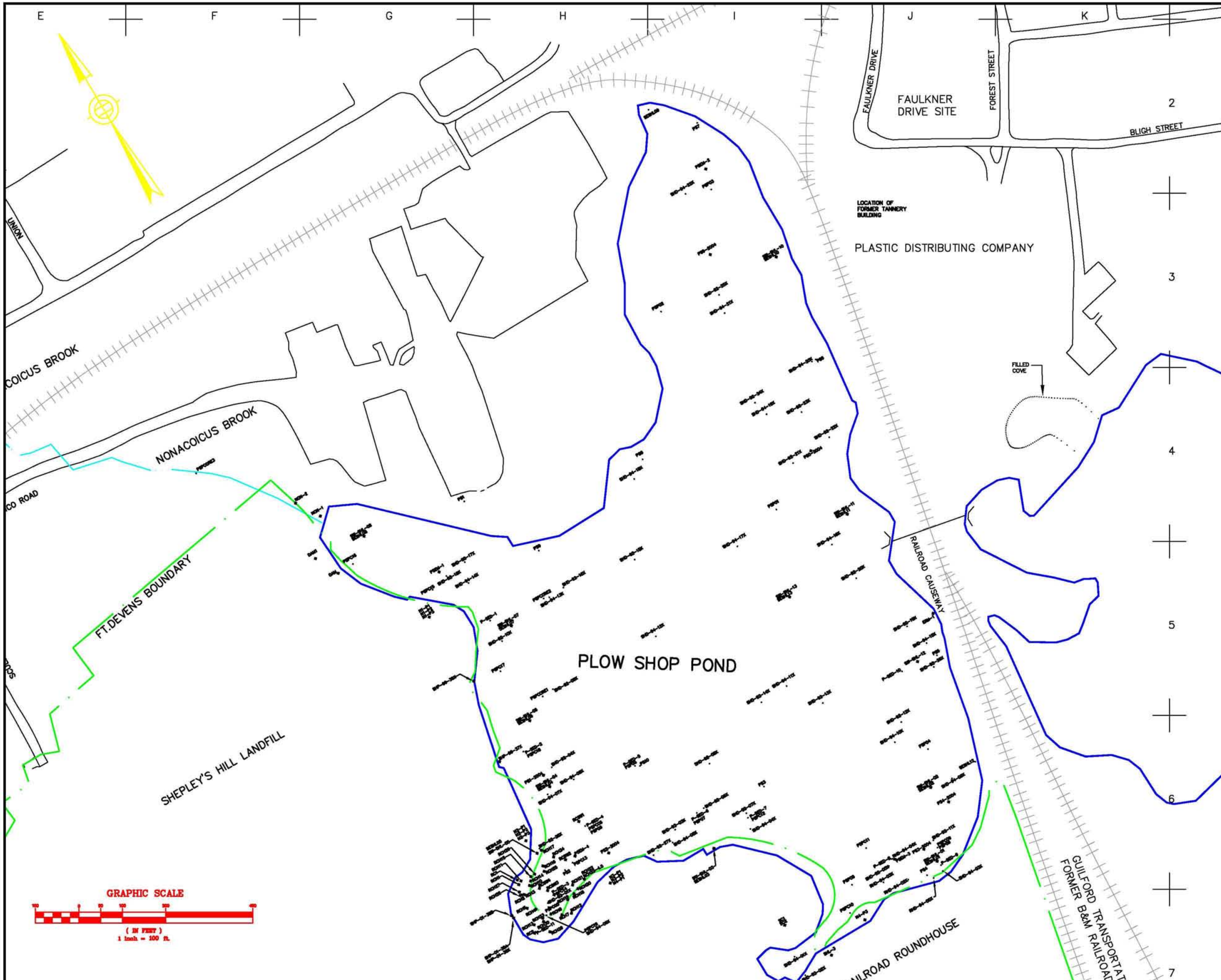
BOSTON, MASSACHUSETTS
EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS
SAMPLE LOCATION PLAN
GROVE POND
3–1



LEGEND:

SURFACE SOIL SAMPLE

SAMPLE IDENTIFICATION (TYP)

CONCENTRATION IN MG/KG (TYP)
R=CONCENTRATION EXCEEDS RESIDENTIAL PRG
L=CONCENTRATION EXCEEDS LOWER EFFECTS LEVEL
S=CONCENTRATION EXCEEDS SEVERE OR MEDIUM EFFECT

SEDIMENT SAMPLE

PIEZOMETER, WHERE A SOIL SAMPLE WAS COLLECTED

SOIL BORING/TEST PIT GRAB SAMPLE

FT. DEVENS BOUNDARY

SURFACE WATER SAMPLE, WHERE A SEDIMENT SAMPLE WAS COLLECTED

INTERMEDIATE MONOTORING WELL, WHERE A SOIL SAMPLE WAS COLLECTED

SHL-20

WATER SUPPLY WELLS, ACTIVE OR INACTIVE

GENERAL NOTES:

1. Base map was originated from the MassGIS database system.
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REGION 1
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BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

SAMPLE LOCATION PLAN
PLOW SHOP POND

DRAWN BY: BT	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 3-2
	TASK ORDER NO. 1	DATE: 05-23-2006	

Gannett Fleming

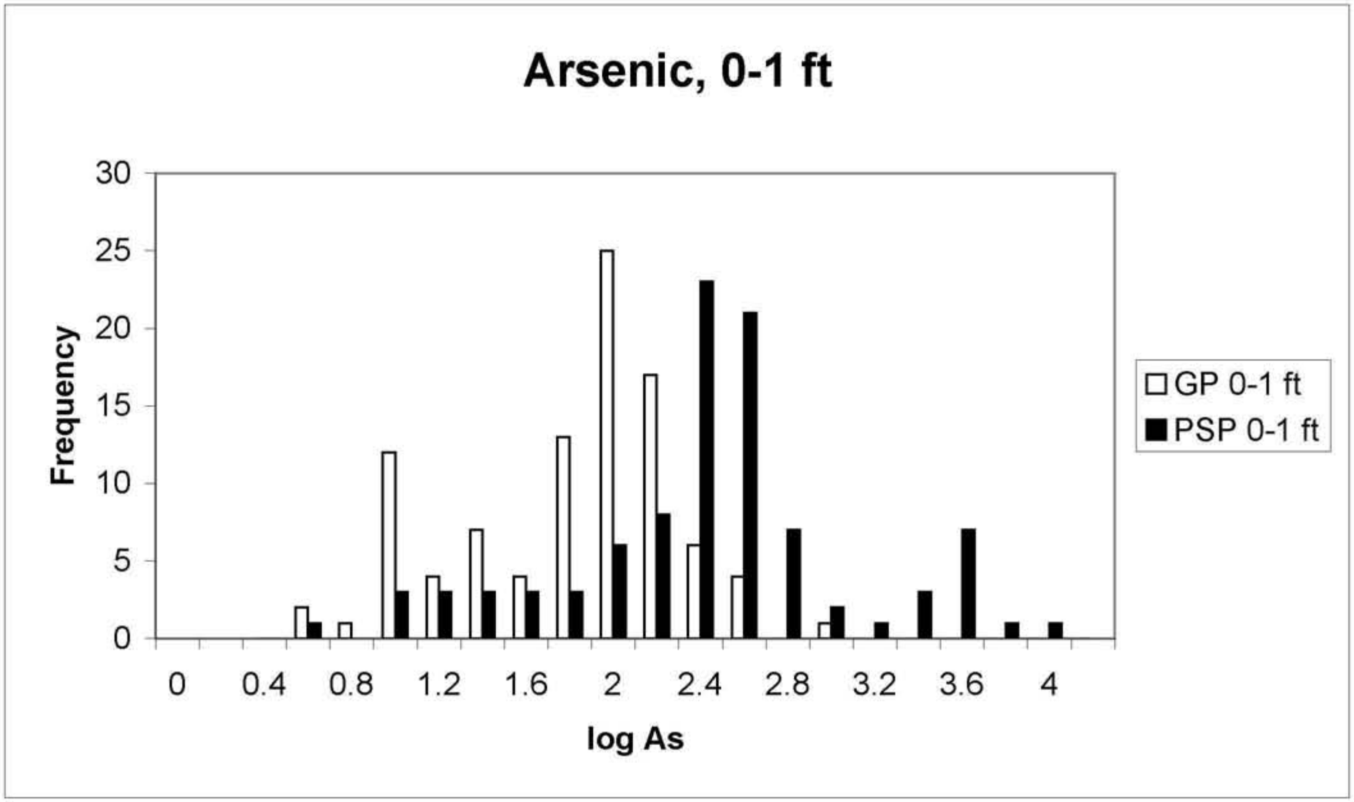
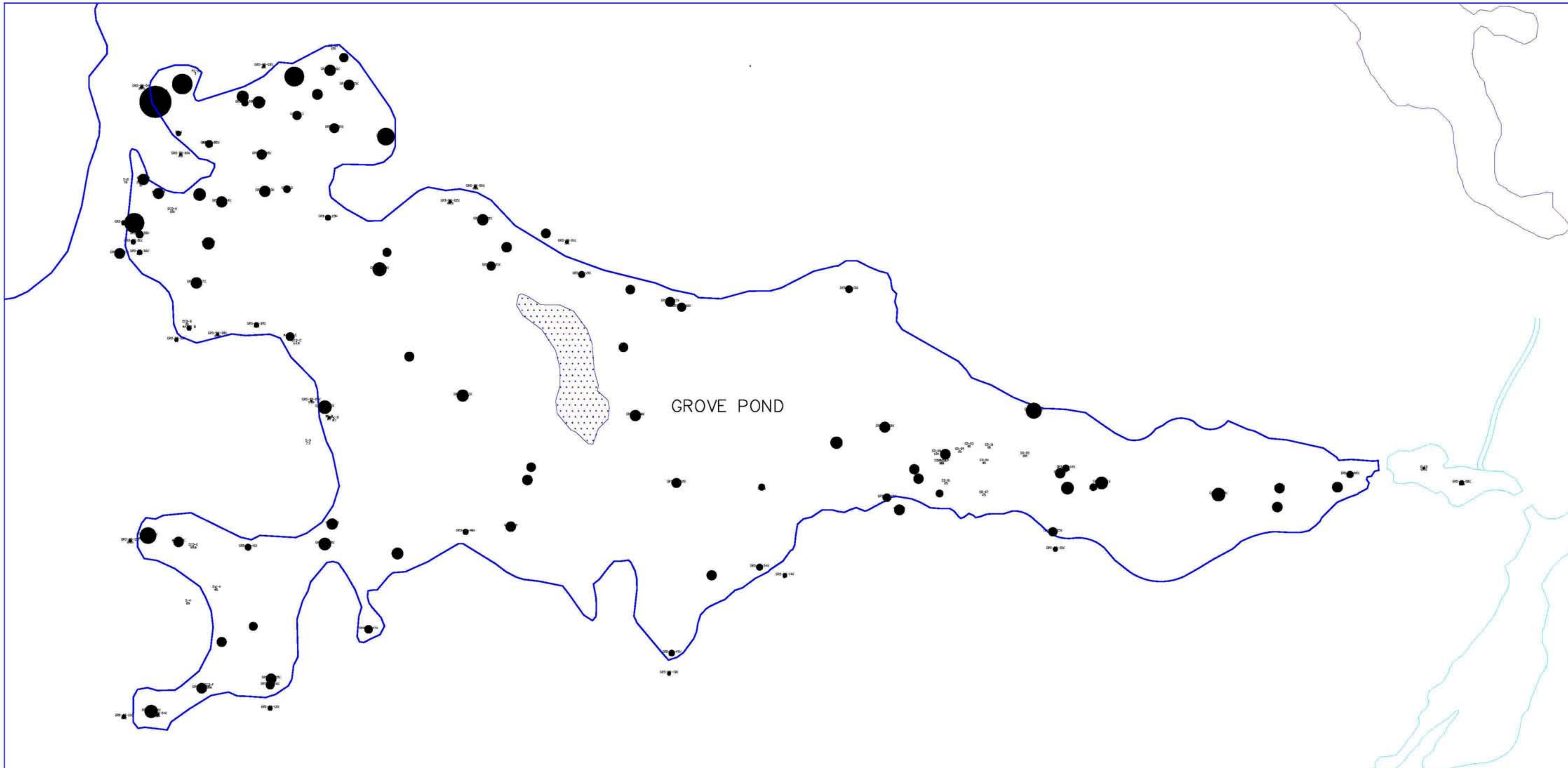


FIGURE NO.: FIGURE 5-1		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF ARSENIC CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to an arsenic concentration of 910 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

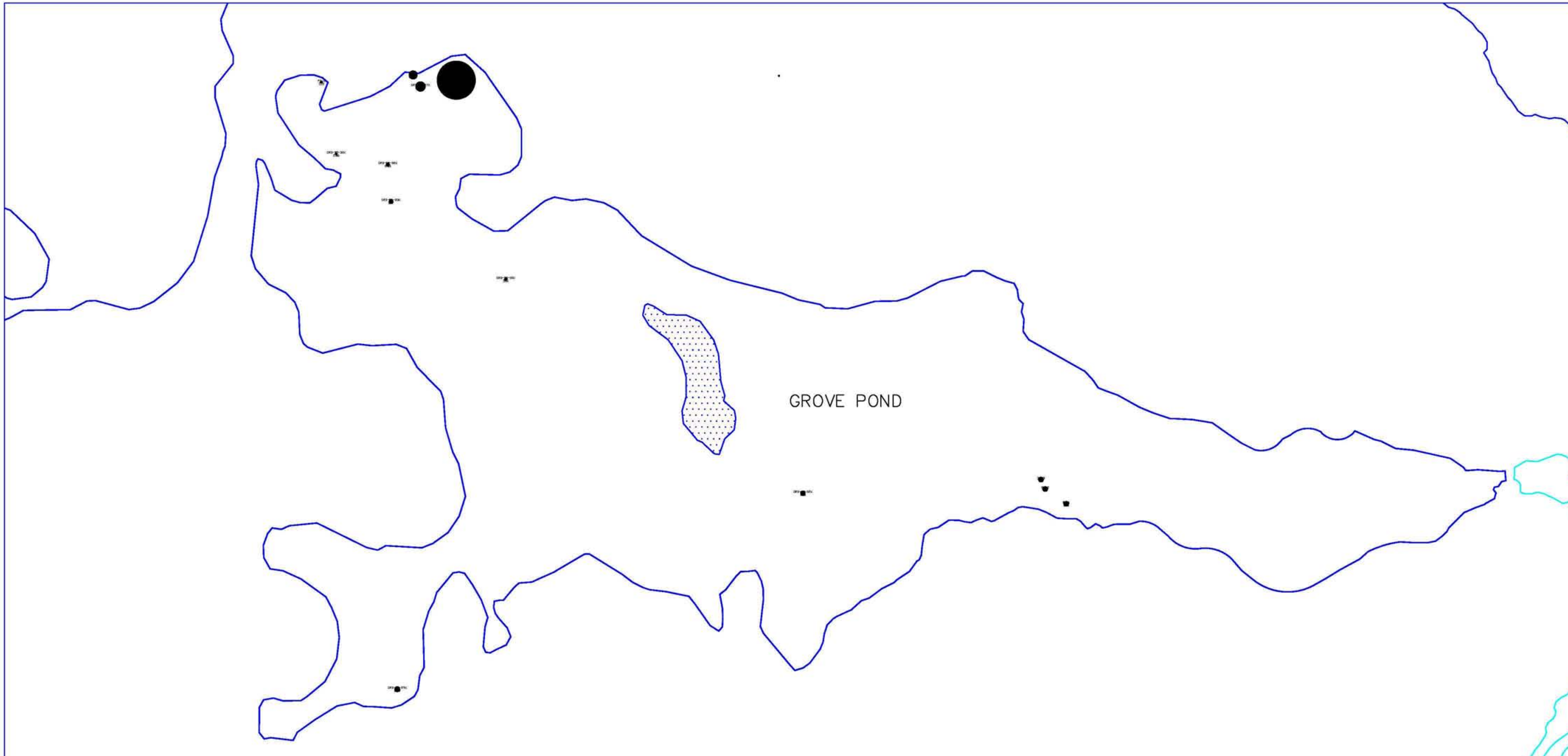
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

ARSENIC IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB | CONTRACT NO. EP-W-05-020 | TASK ORDER NO. 1 | SCALE: AS SHOWN | DATE: DEC, 2005 | FIGURE NO. 5–2

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to an arsenic concentration of 1,300 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

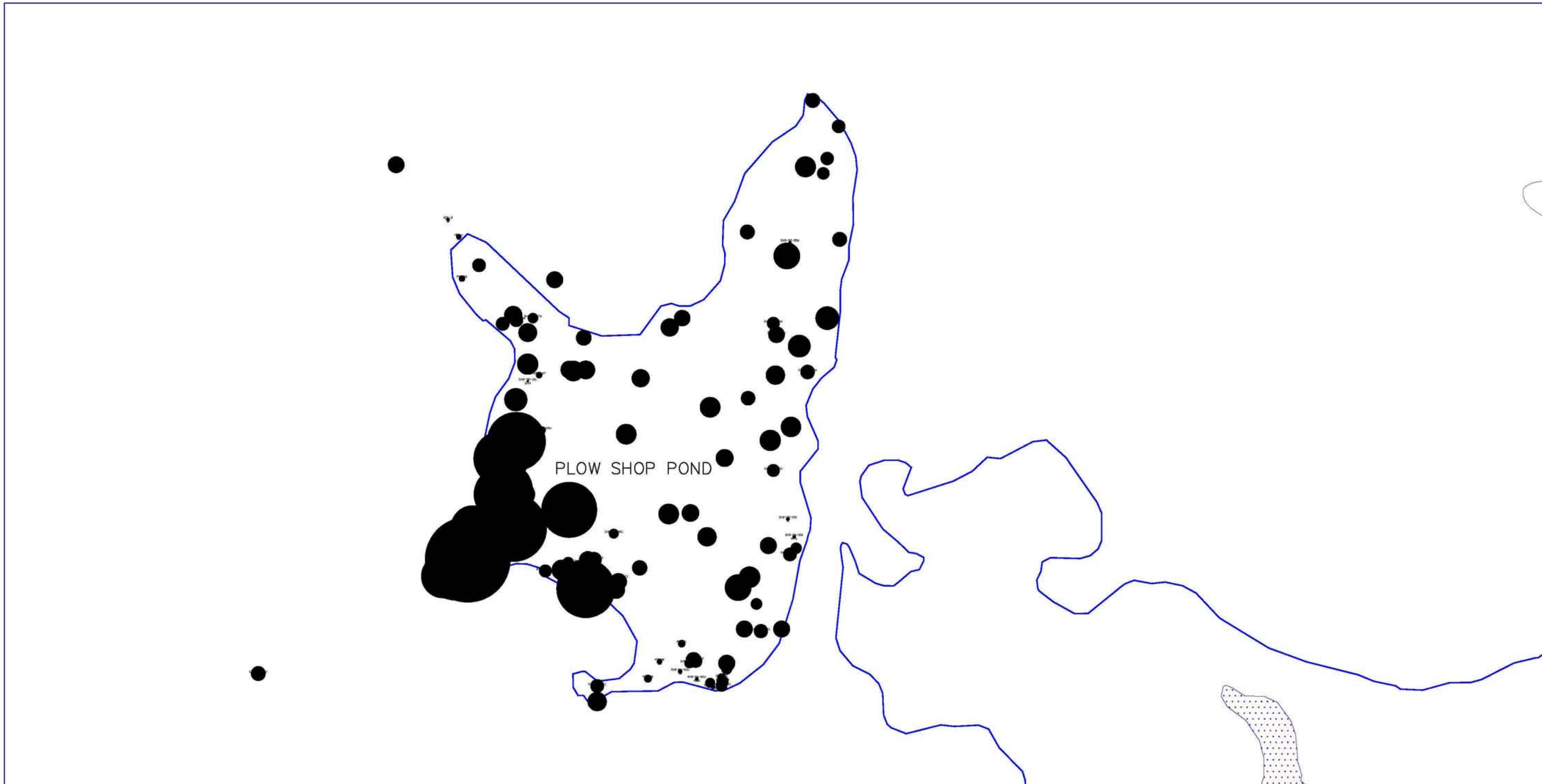
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

ARSENIC IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5-3
	TASK ORDER NO. 1	DATE: DEC, 2005	

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to an arsenic concentration of 6,800 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

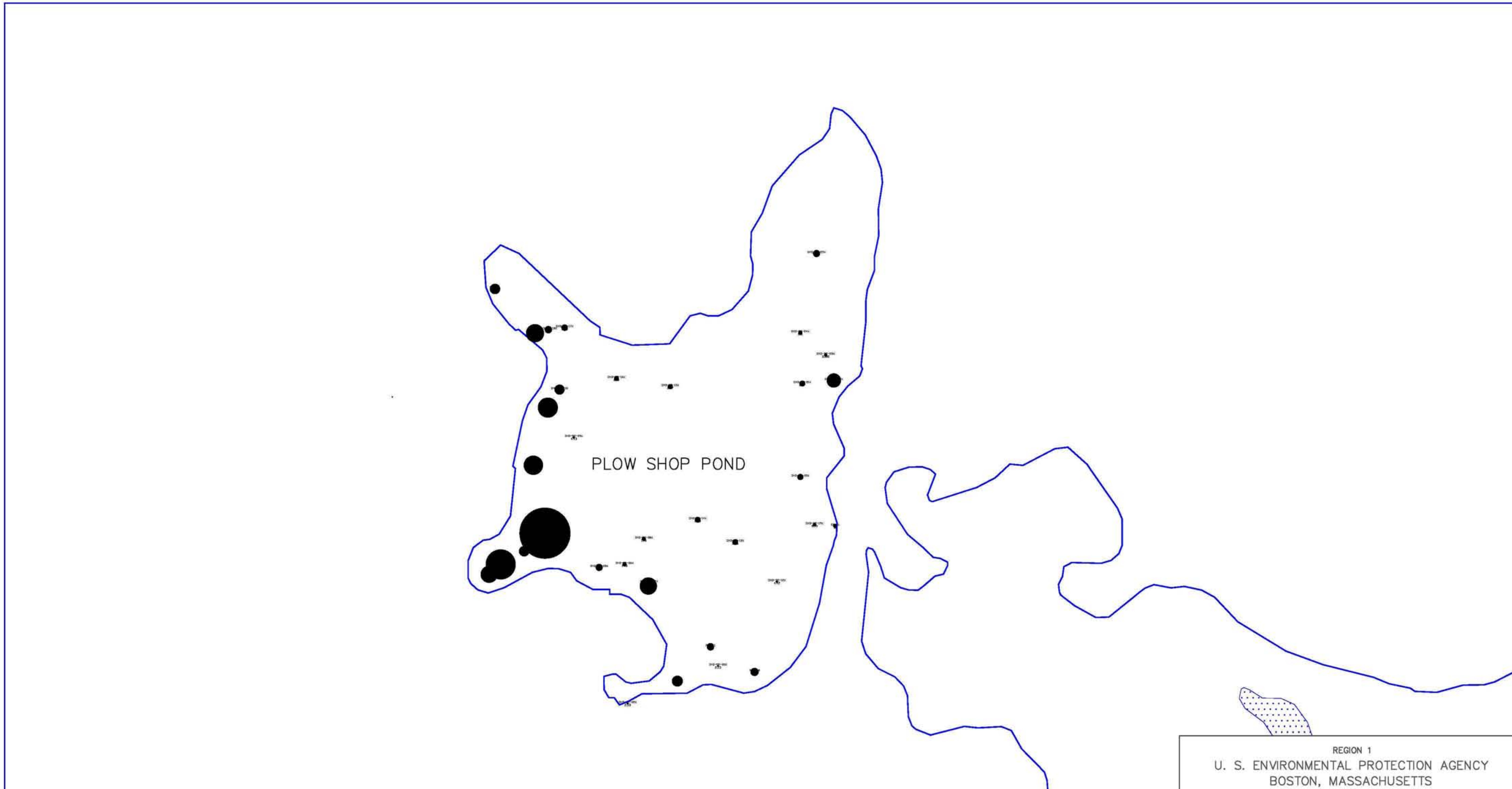
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

ARSENIC IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5-4

Gannett Fleming



Notes:

1. Base map was originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to an arsenic concentration of 2,500 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

ARSENIC IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5-5
	TASK ORDER NO. 1	DATE: DEC, 2005	

Gannett Fleming

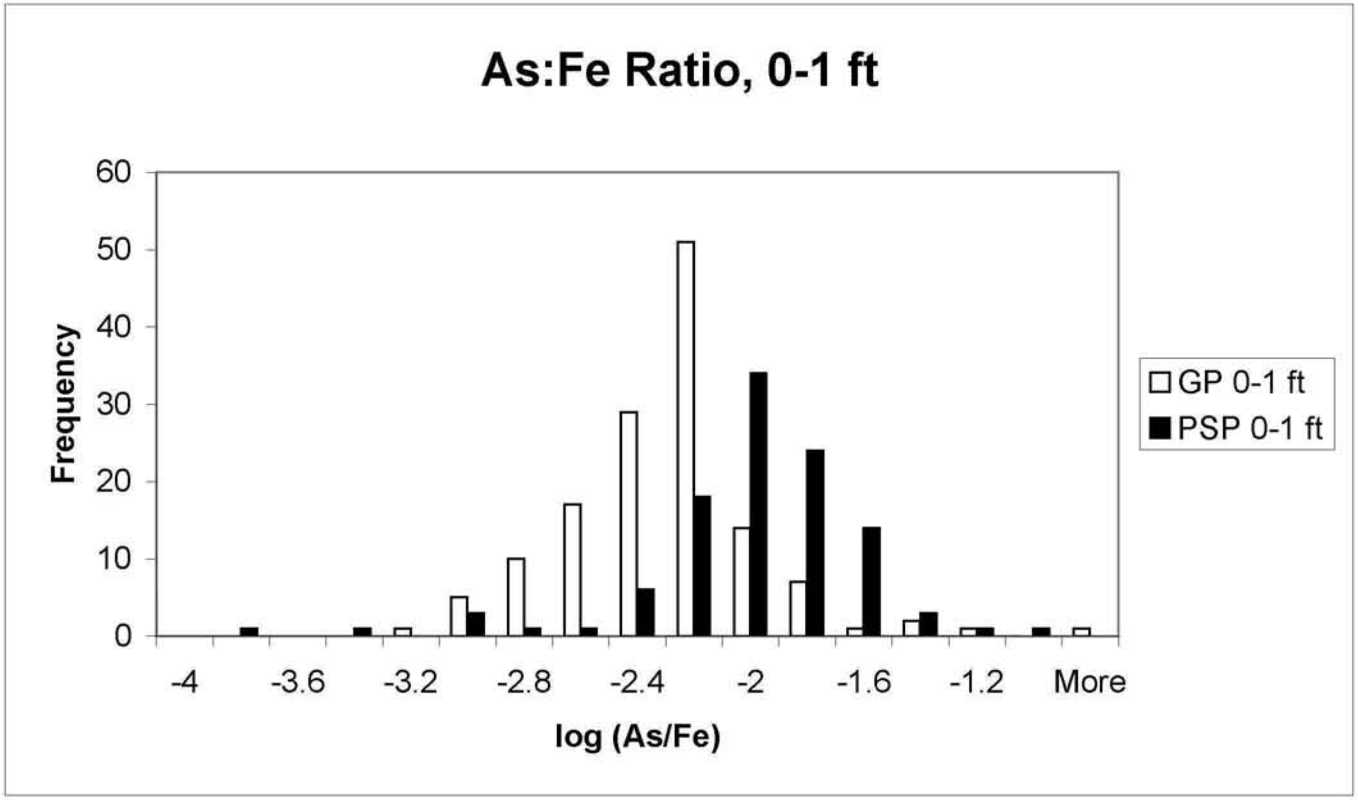


FIGURE NO.: FIGURE 5-6		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
ARSENIC AND IRON RATIO 0 -1 FOOT BELOW GRADE GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

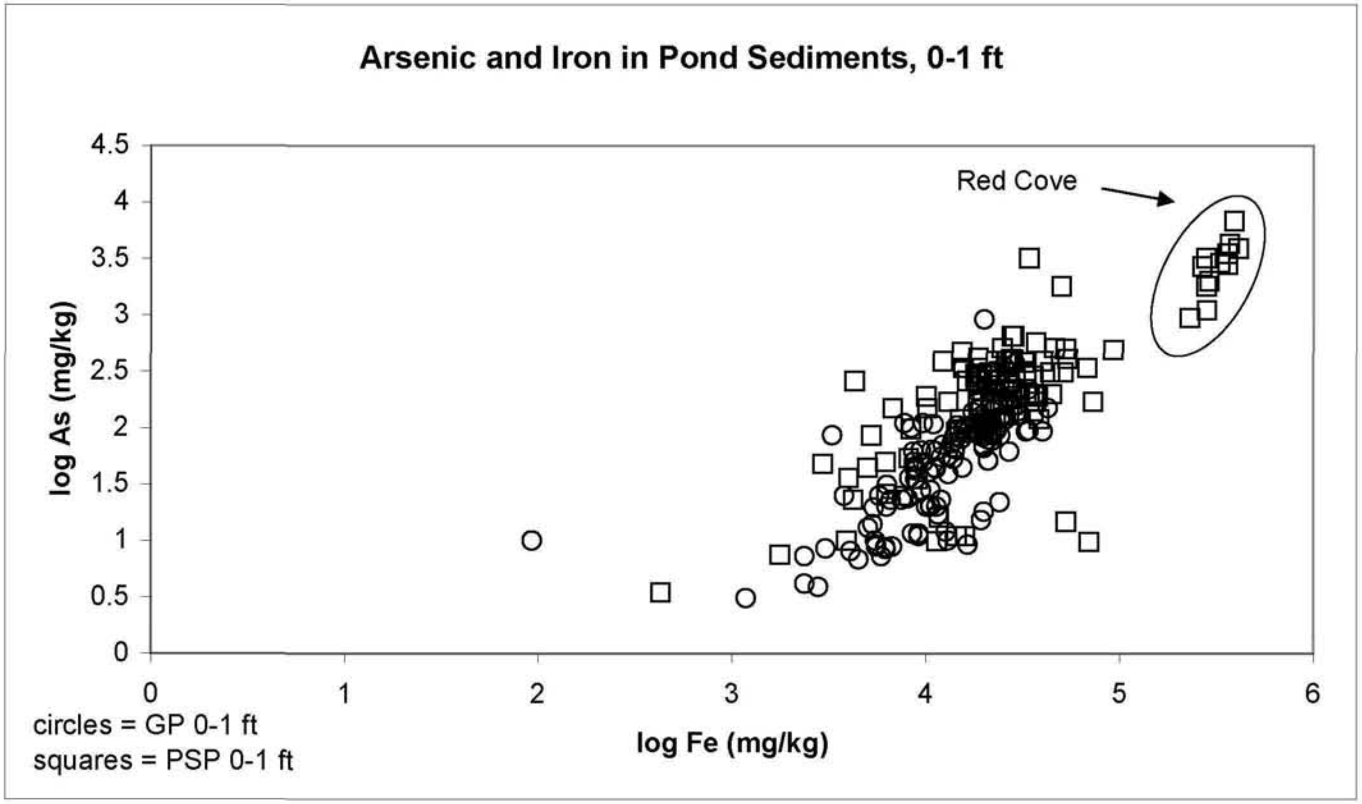
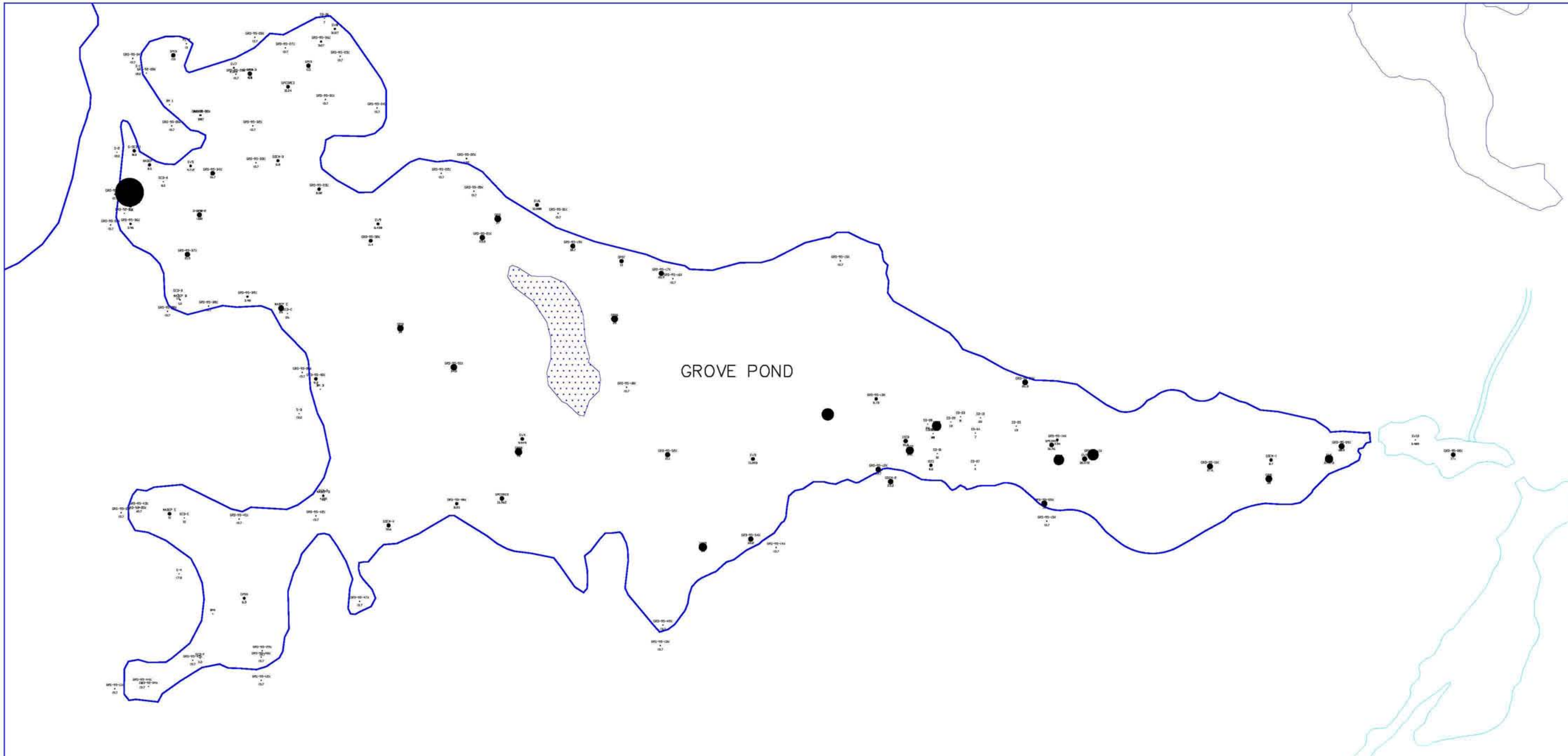


FIGURE NO.: FIGURE 5-7		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
ARSENIC vs. IRON IN SHALLOW SEDIMENT 0 -1 FOOT BELOW GRADE GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a cadmium concentration of 730 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CADMIUM IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5–8

Gannett Fleming

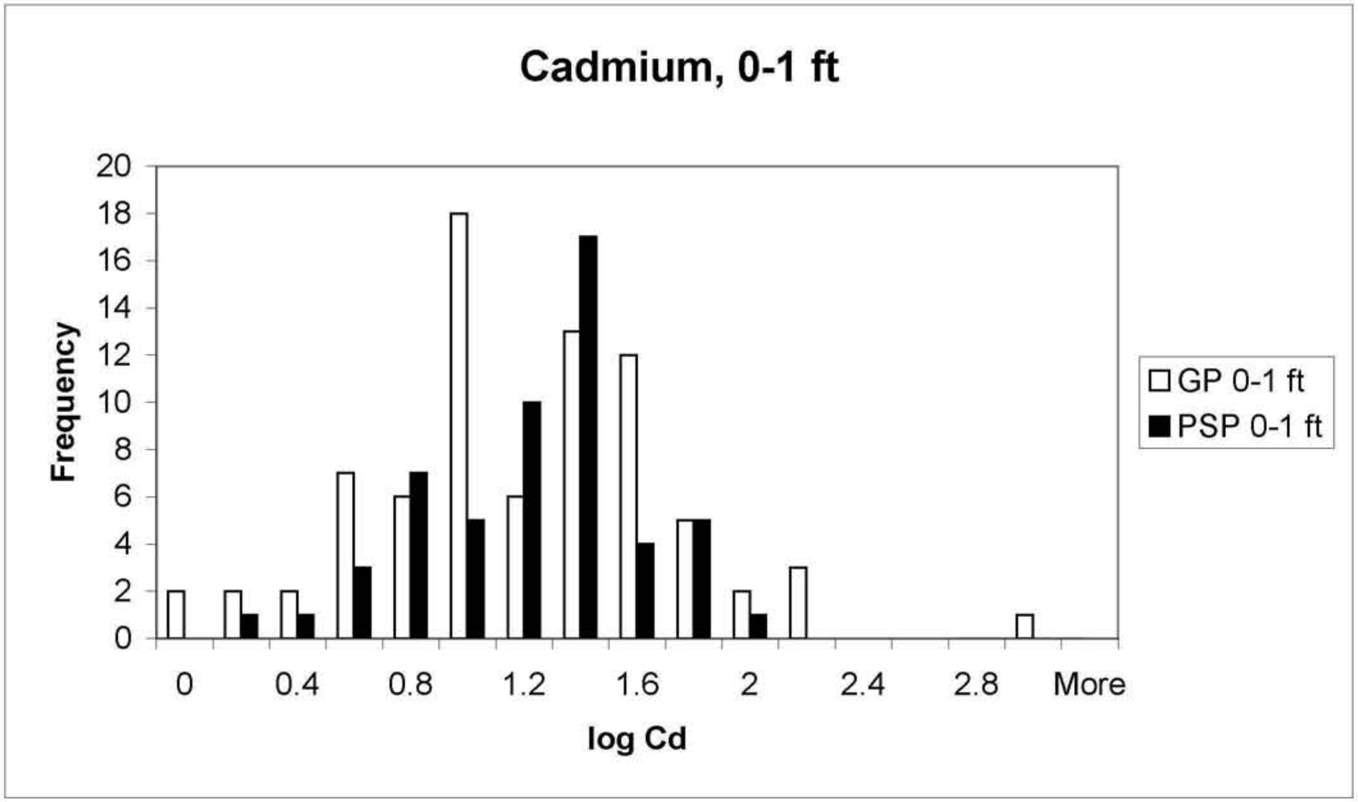
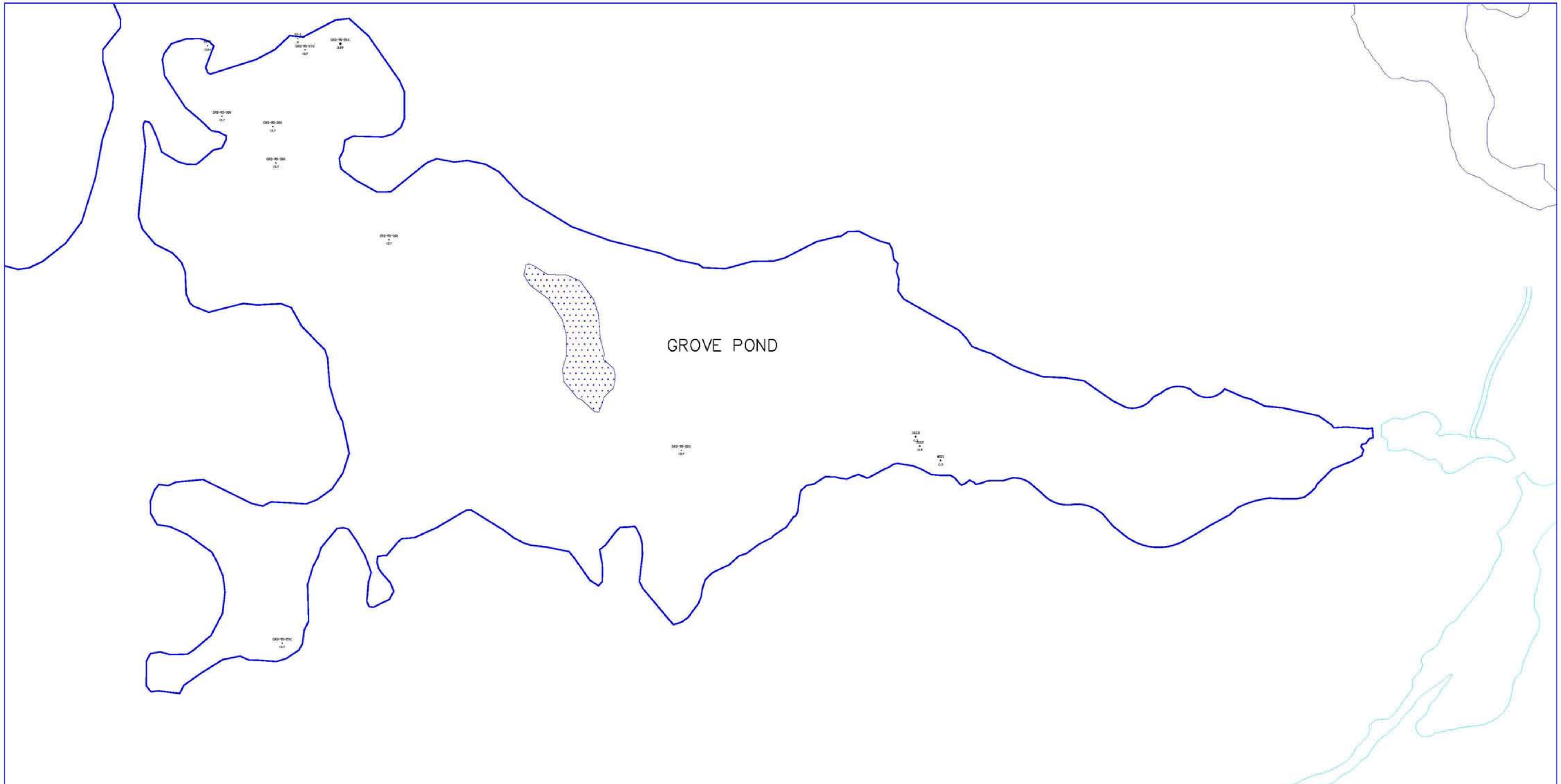


FIGURE NO.: FIGURE 5-9		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF CADMIUM CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a cadmium concentration of 3.59 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

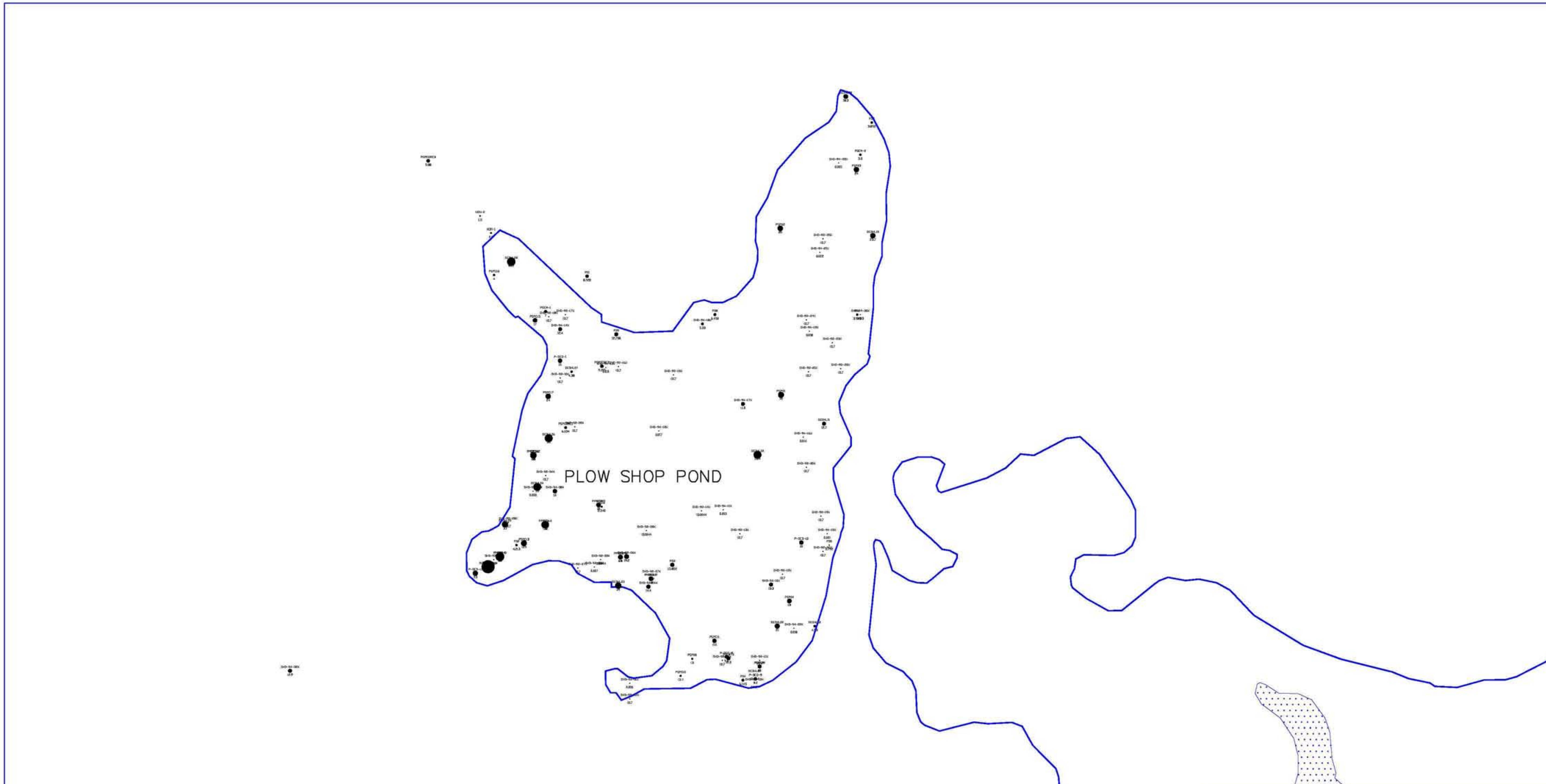
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CADMIUM IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5-10
	TASK ORDER NO. 1	DATE: DEC, 2005	

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a cadmium concentration of 66 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

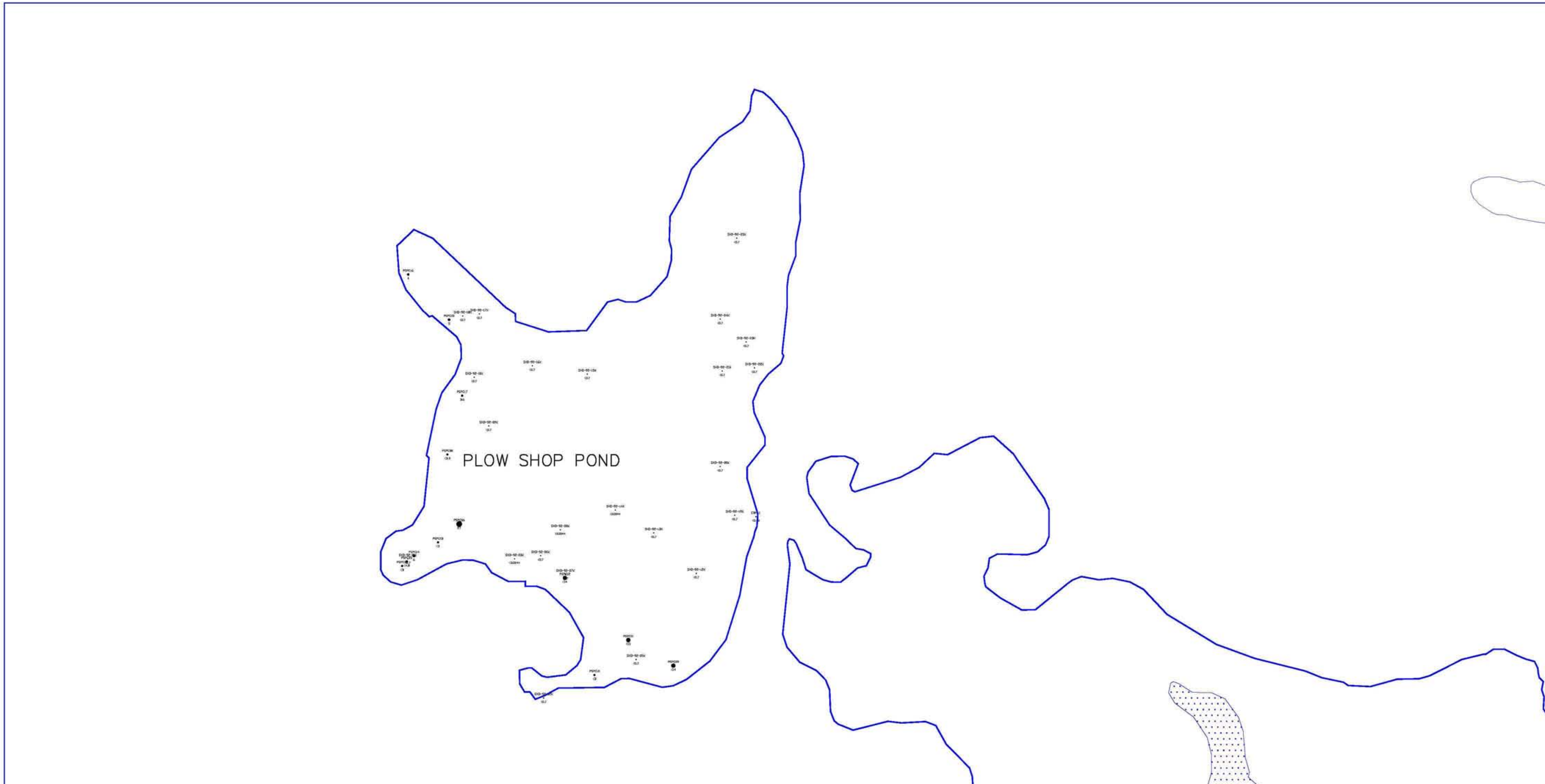
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CADMIUM IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5–11
	TASK ORDER NO. 1	DATE: DEC, 2005	

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a cadmium concentration of 430 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CADMIUM IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC. 2005	5-12

Gannett Fleming

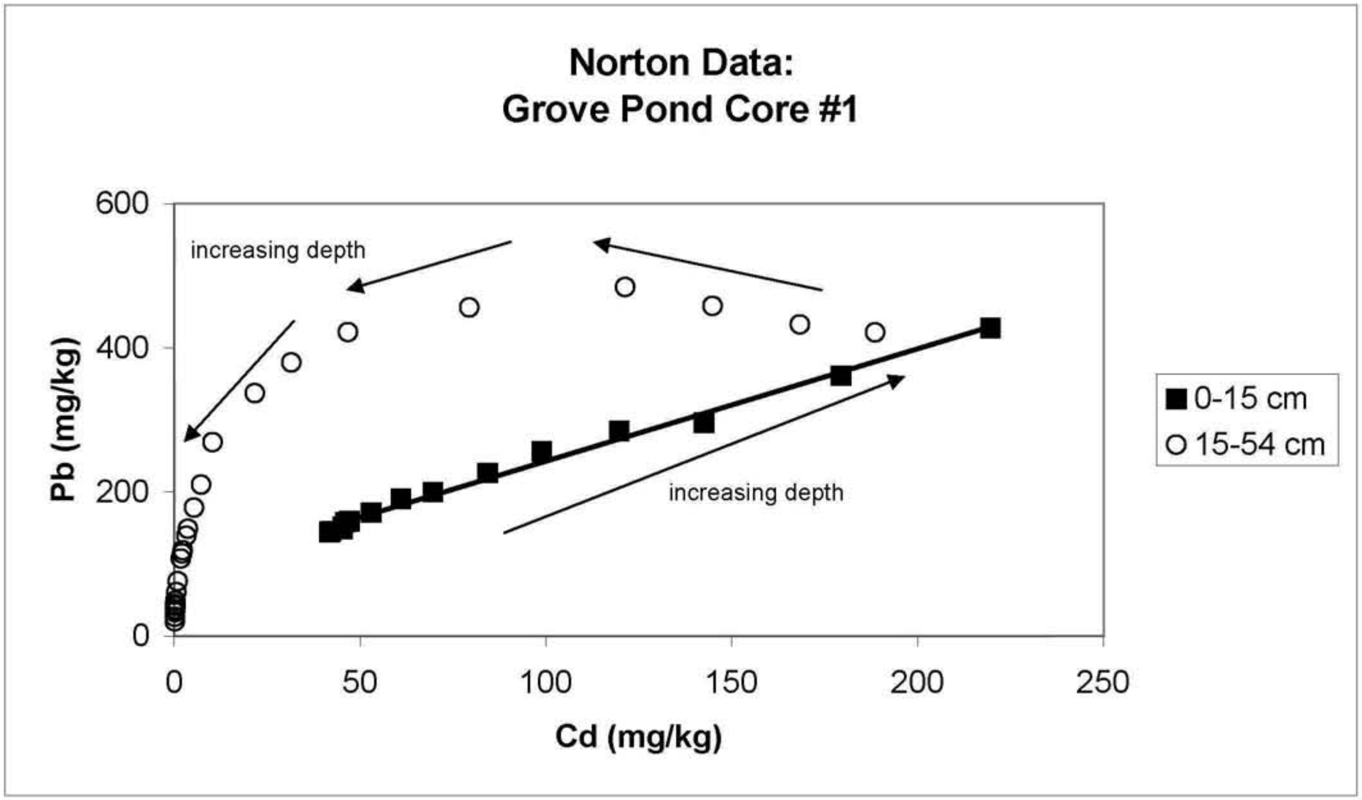


FIGURE NO.: FIGURE 5-13		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
CADMIUM vs. LEAD NORTON DATA GROVE POND CORE #1		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

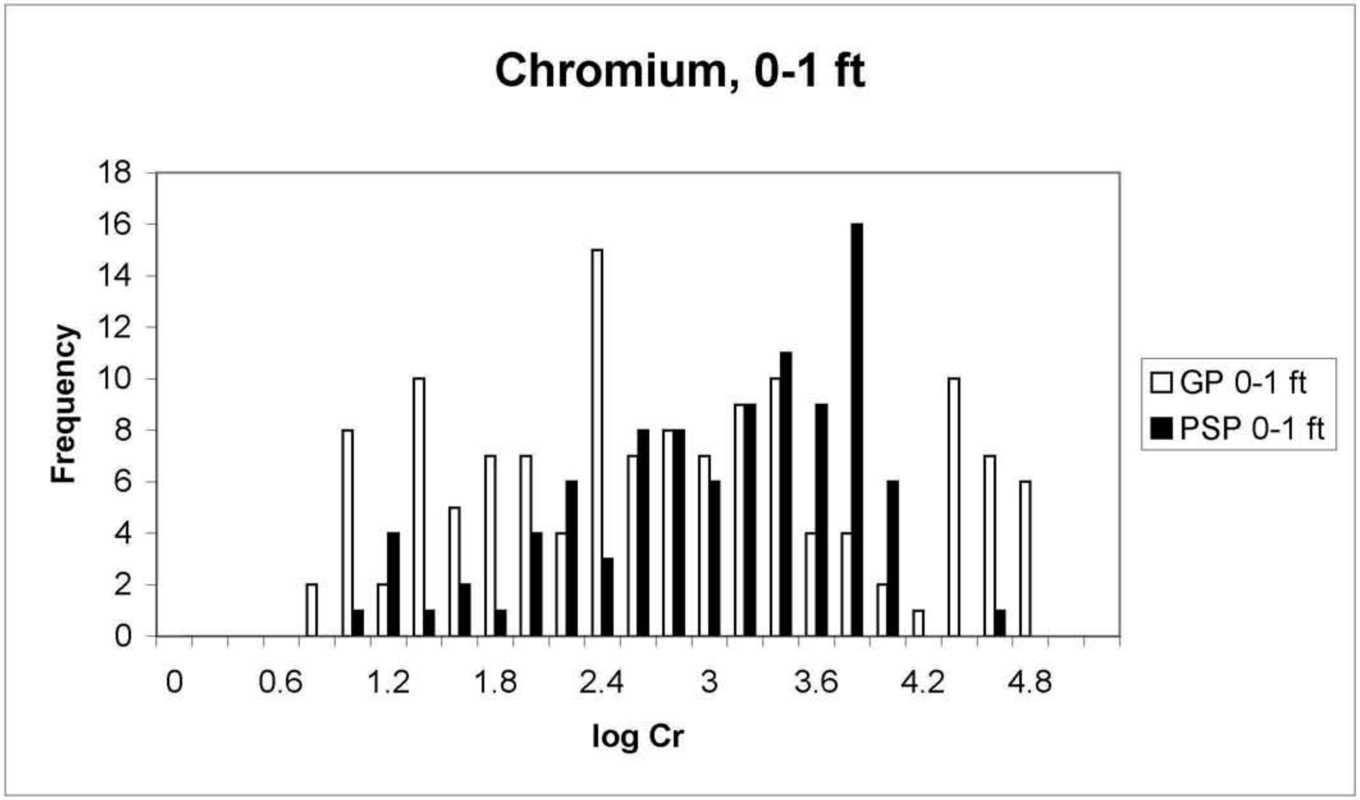
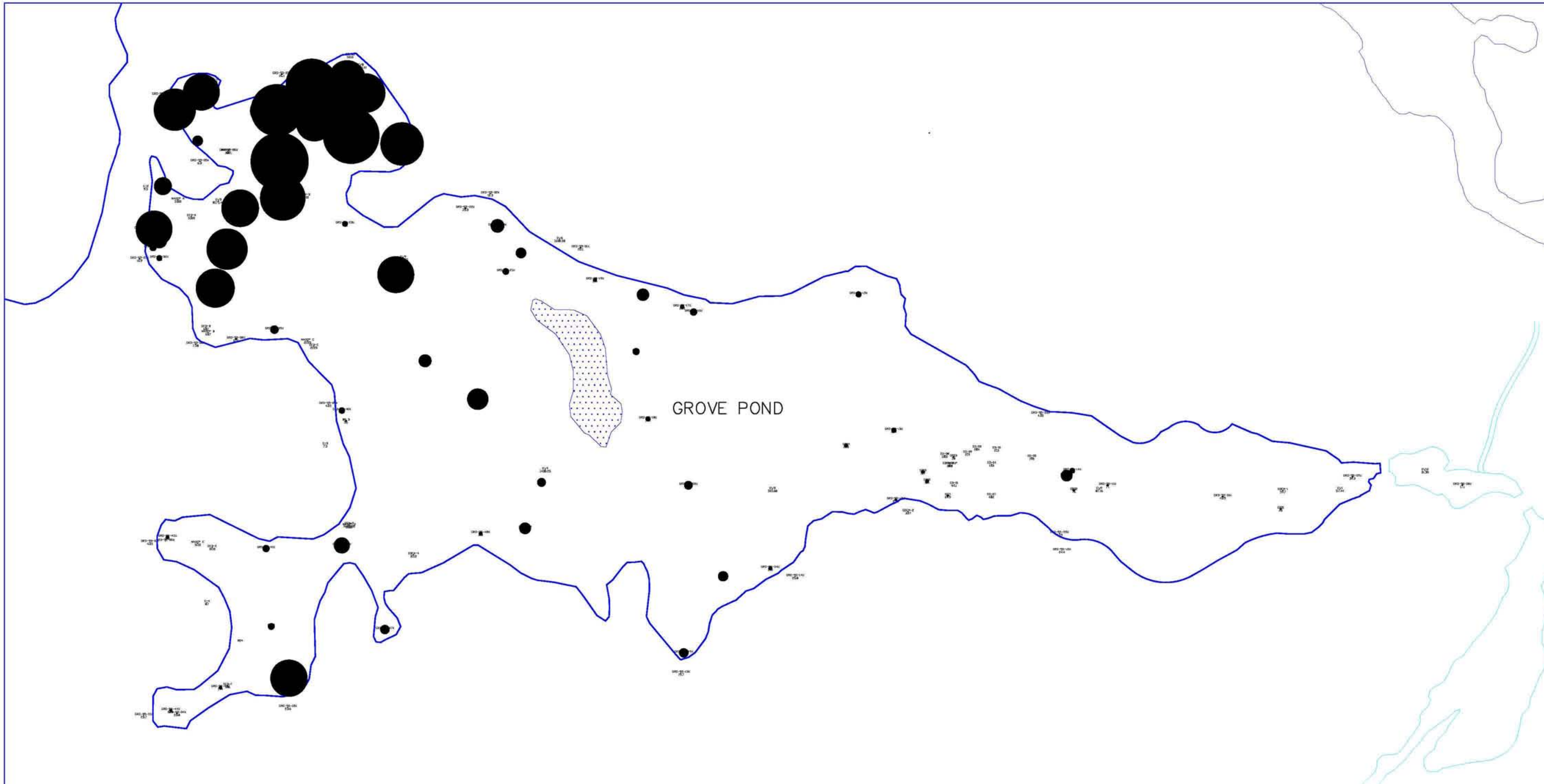


FIGURE NO.: FIGURE 5-14		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF CHROMIUM CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a chromium concentration of 52,000 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

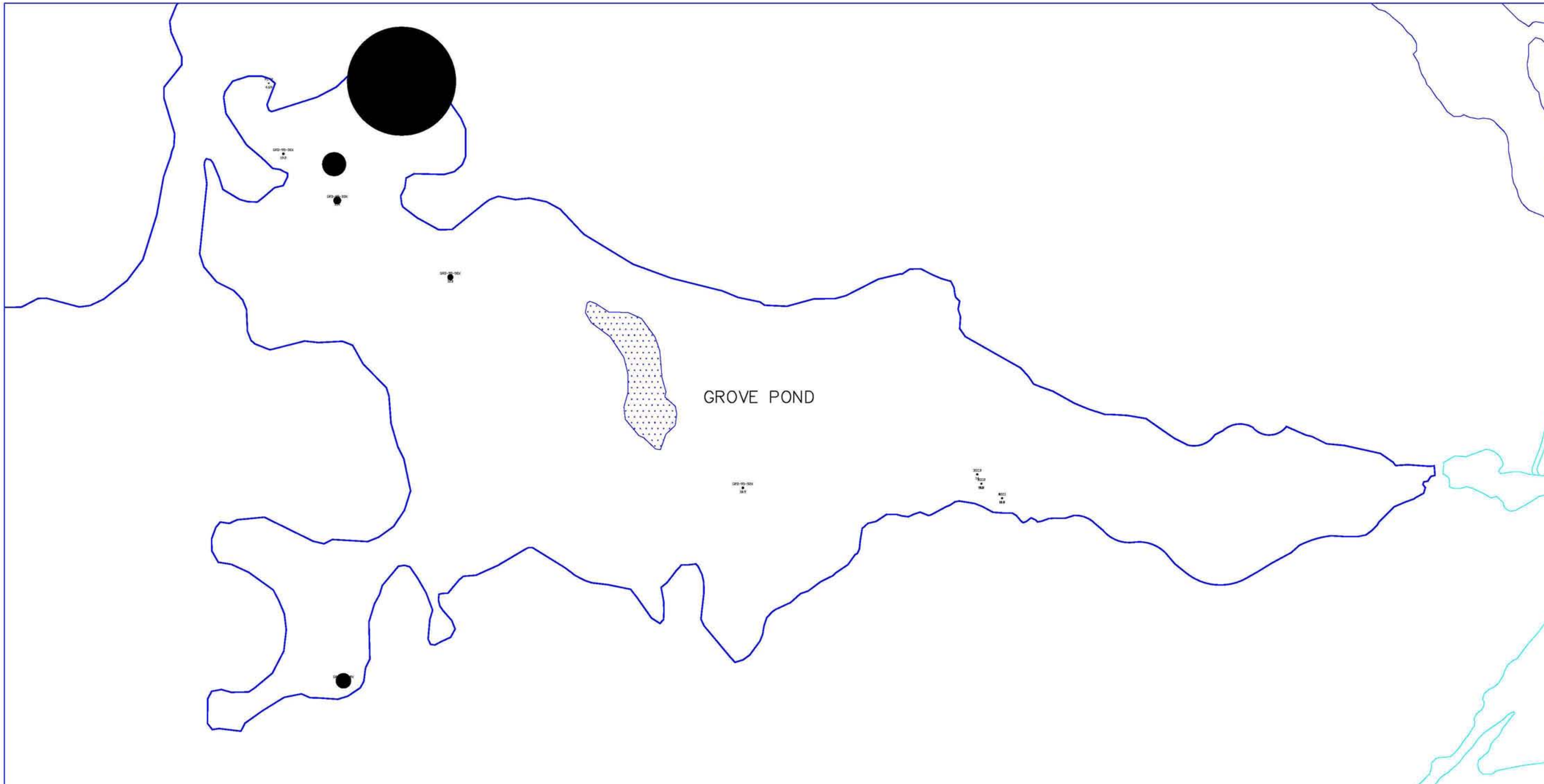
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CHROMIUM IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC. 2005	FIGURE NO. 5–15

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a chromium concentration of 44,000 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

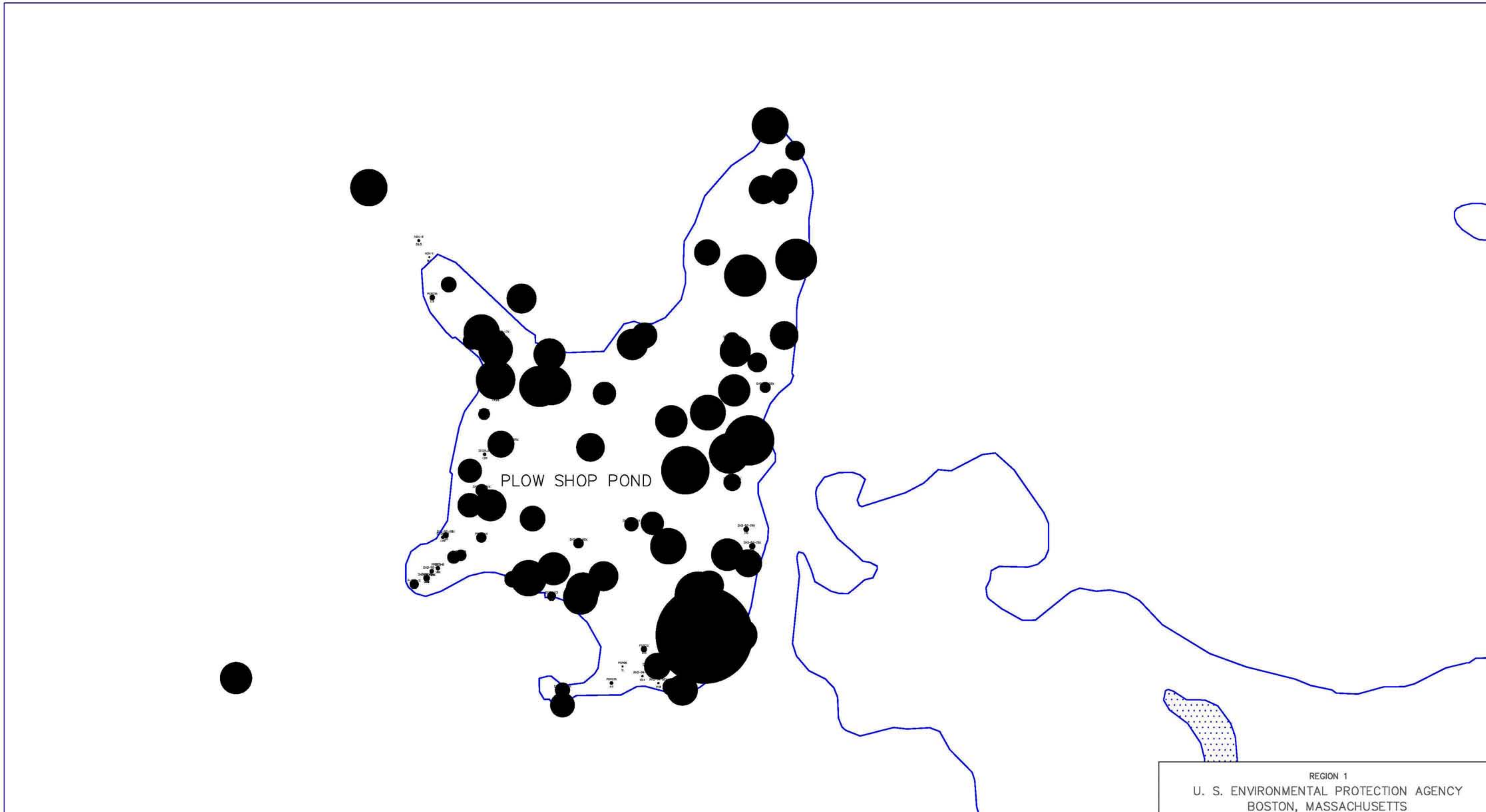
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CHROMIUM IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 / TASK ORDER NO. 1	SCALE: AS SHOWN / DATE: DEC, 2005	FIGURE NO. 5-16

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a chromium concentration of 37,800 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

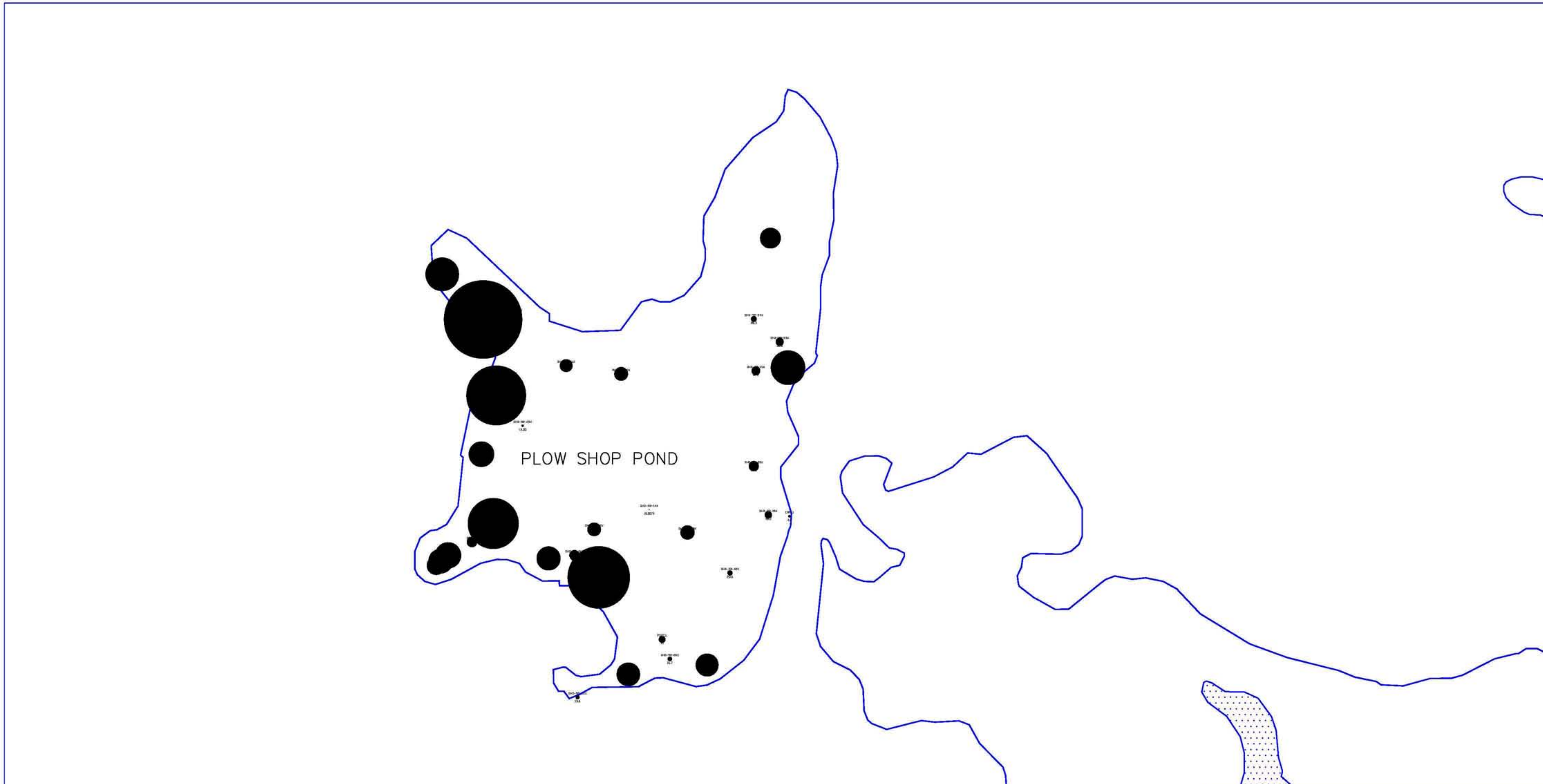
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CHROMIUM IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC. 2005	5–17

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a chromium concentration of 5,700 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CHROMIUM IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5-18
	TASK ORDER NO. 1	DATE: DEC. 2005	

Gannett Fleming

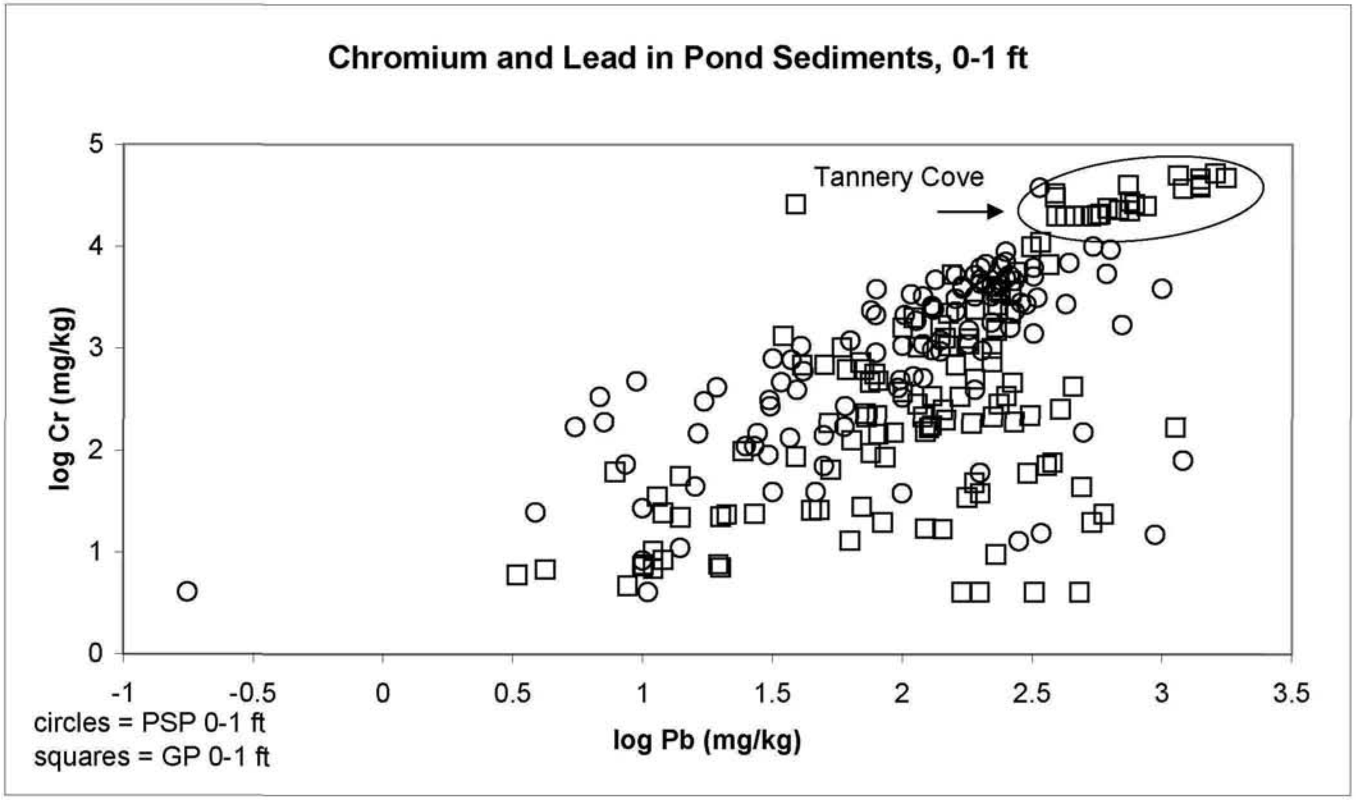


FIGURE NO.: FIGURE 5-19		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
CHROMIUM vs. LEAD IN SHALLOW SEDIMENT 0 -1 FOOT BELOW GRADE GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

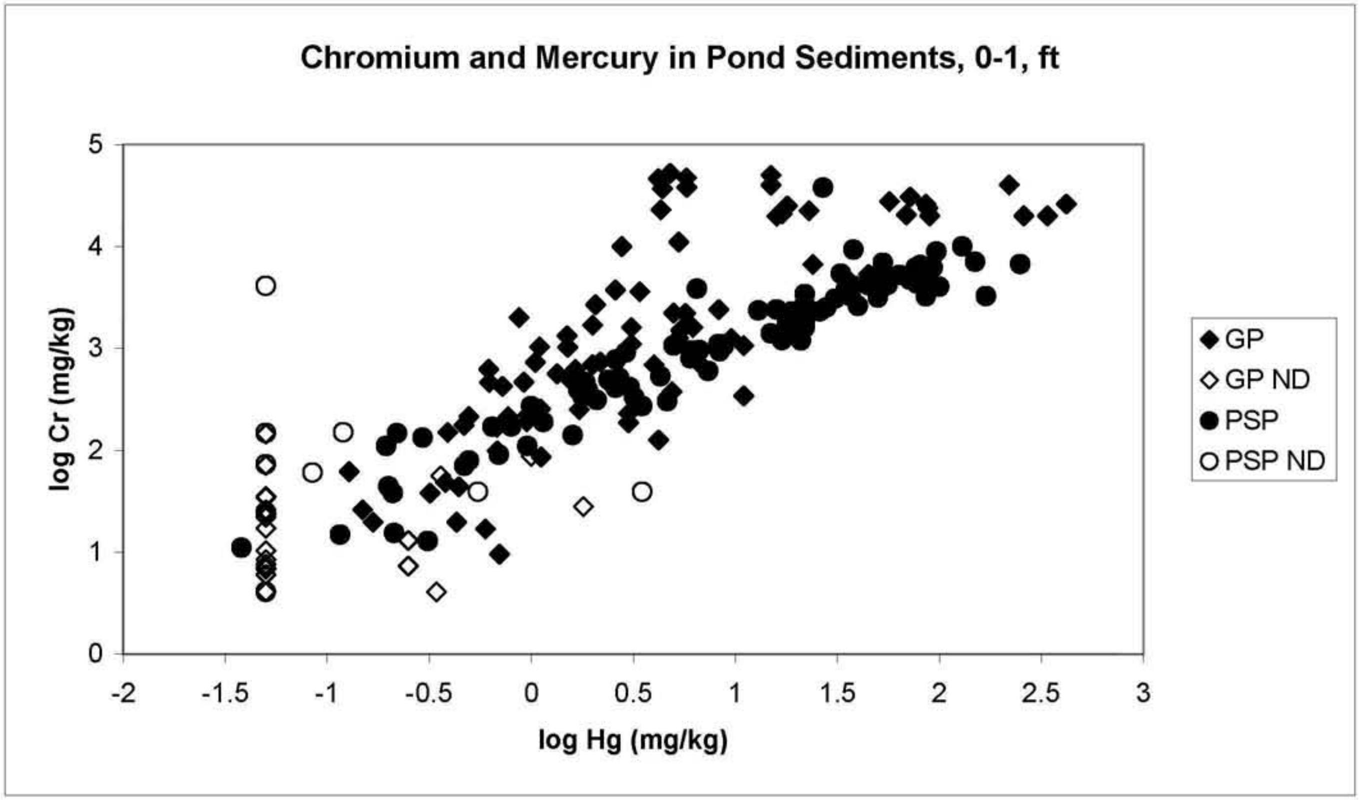
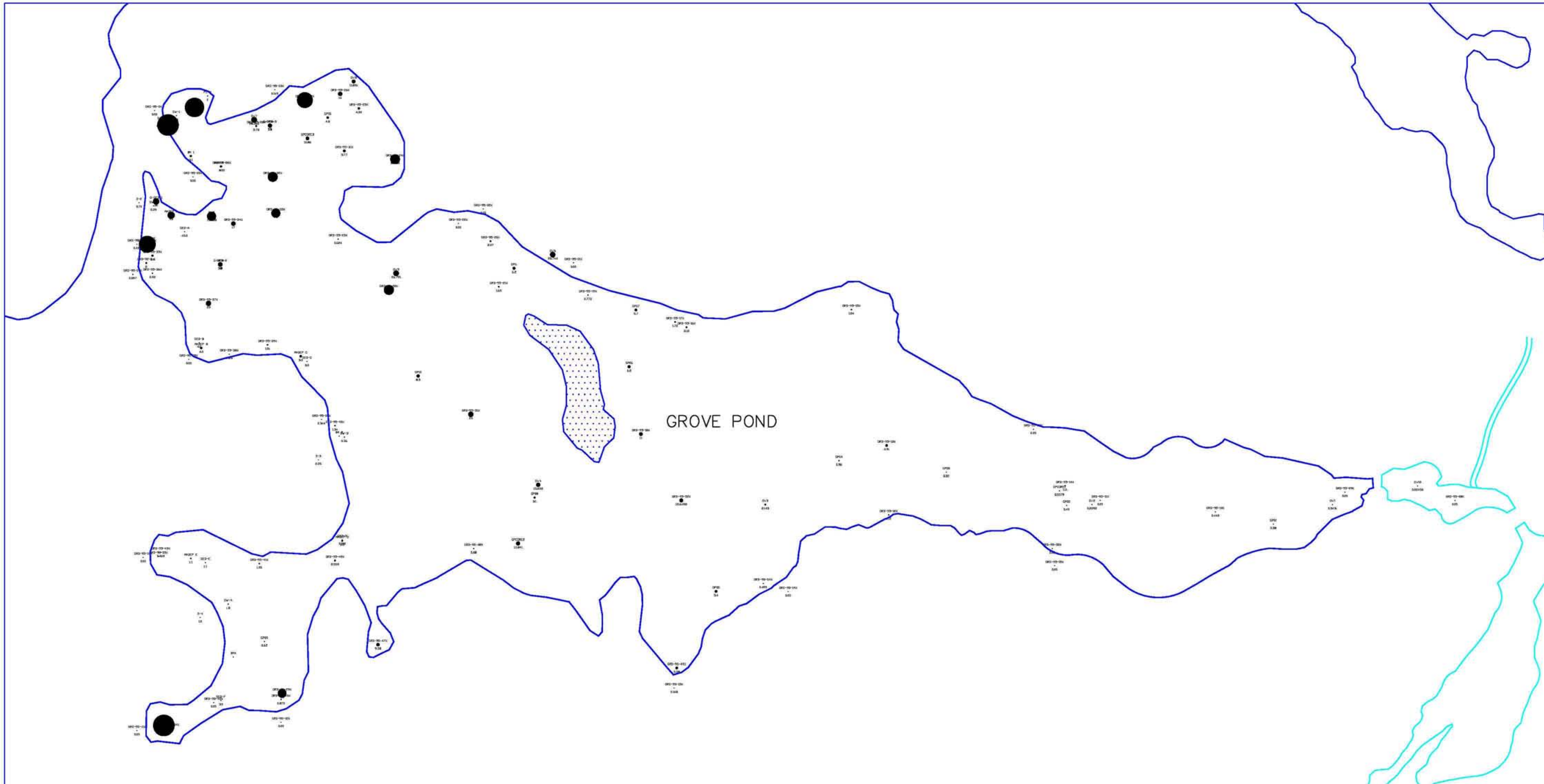


FIGURE NO.: FIGURE 5-20		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
CHROMIUM vs. MERCURY IN SHALLOW SEDIMENT 0 -1 FOOT BELOW GRADE GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a mercury concentration of 420 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

MERCURY IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5–21
	TASK ORDER NO. 1	DATE: DEC, 2005	

Gannett Fleming

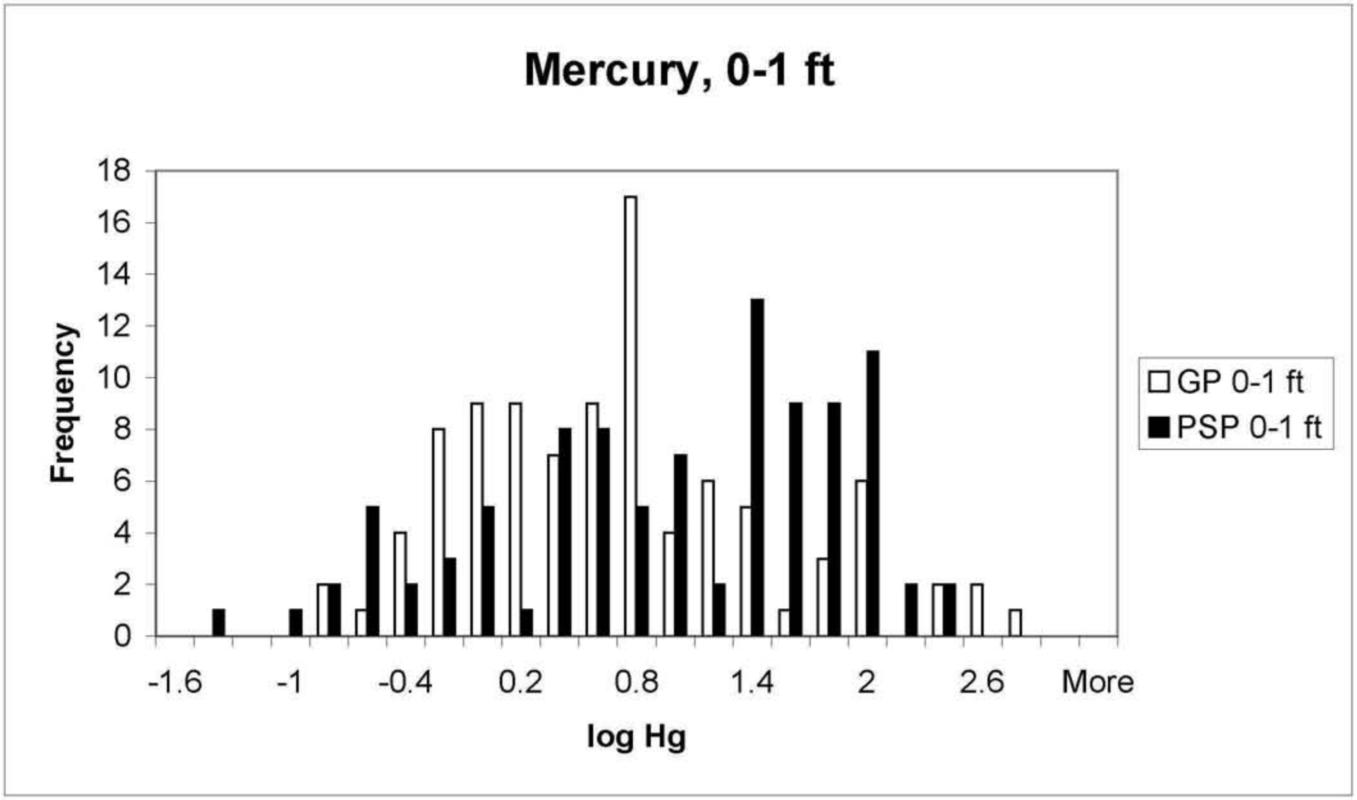
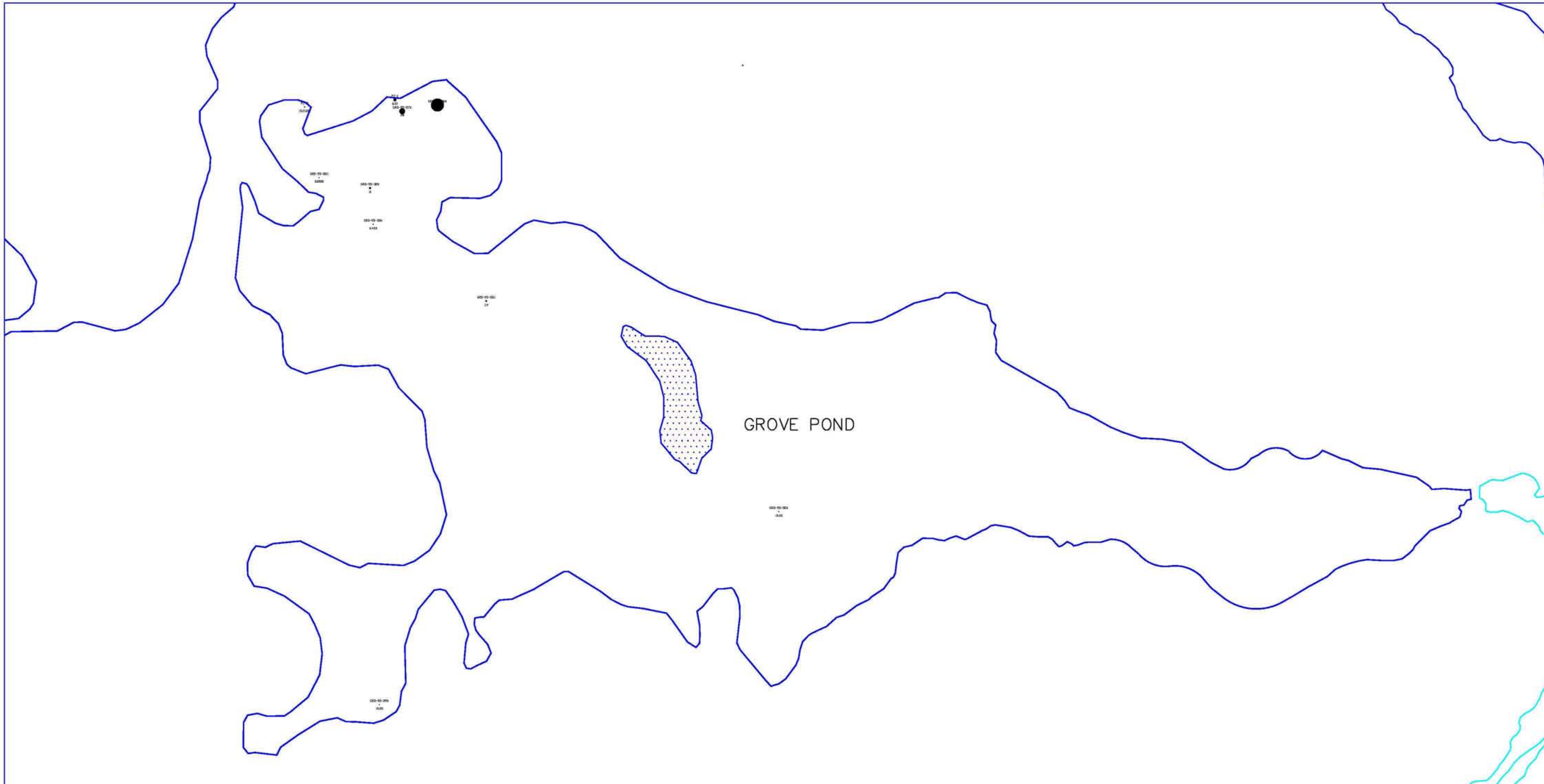


FIGURE NO.: FIGURE 5-22		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF MERCURY CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a mercury concentration of 150 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

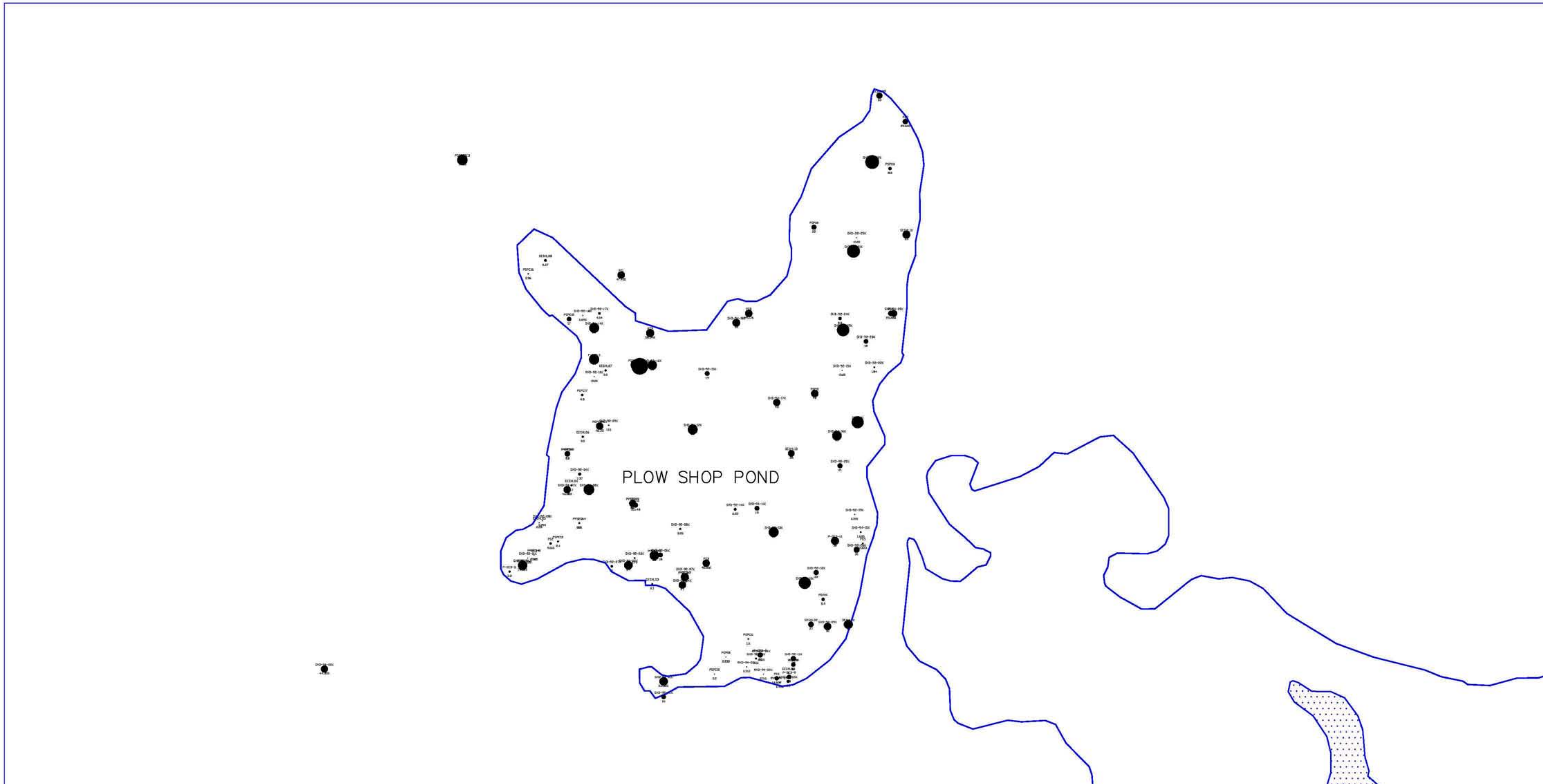
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

MERCURY IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5-23

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a mercury concentration of 250 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

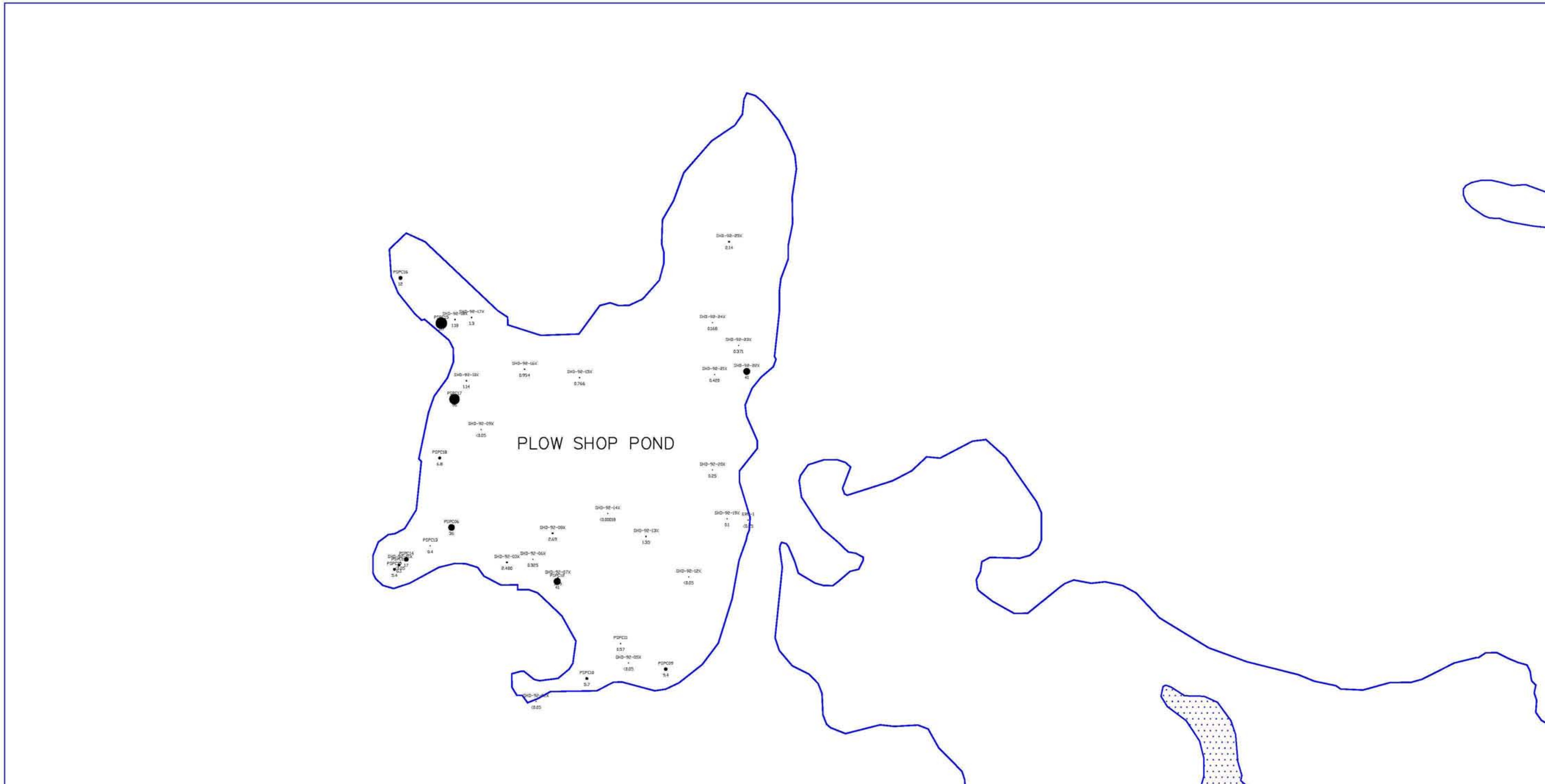
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

MERCURY IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5–24
	TASK ORDER NO. 1	DATE: DEC, 2005	

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a mercury concentration of 220 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

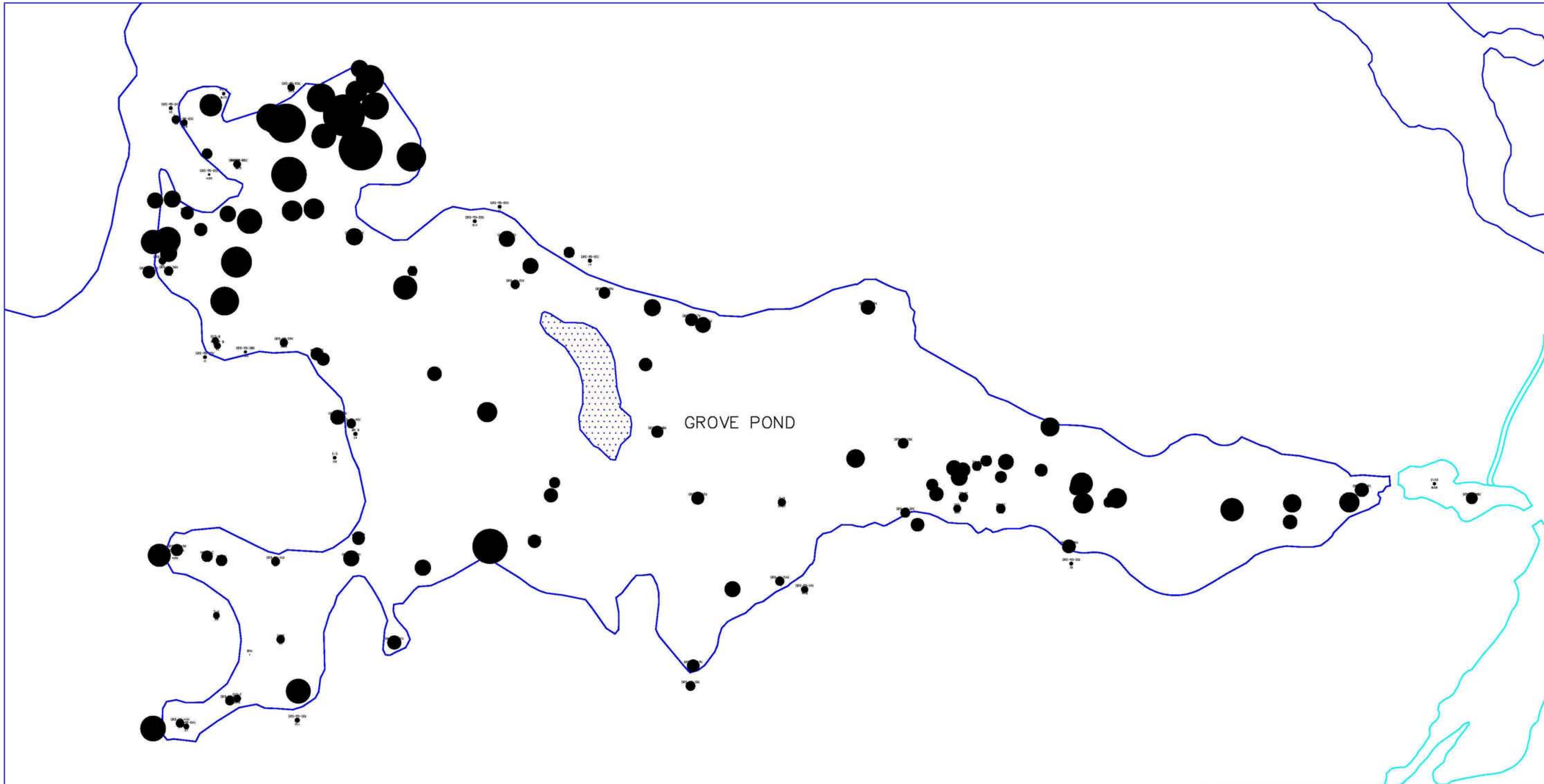
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

MERCURY IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5–25

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a lead concentration of 1,760 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

LEAD IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5–26
	TASK ORDER NO. 1	DATE: DEC. 2005	

Gannett Fleming

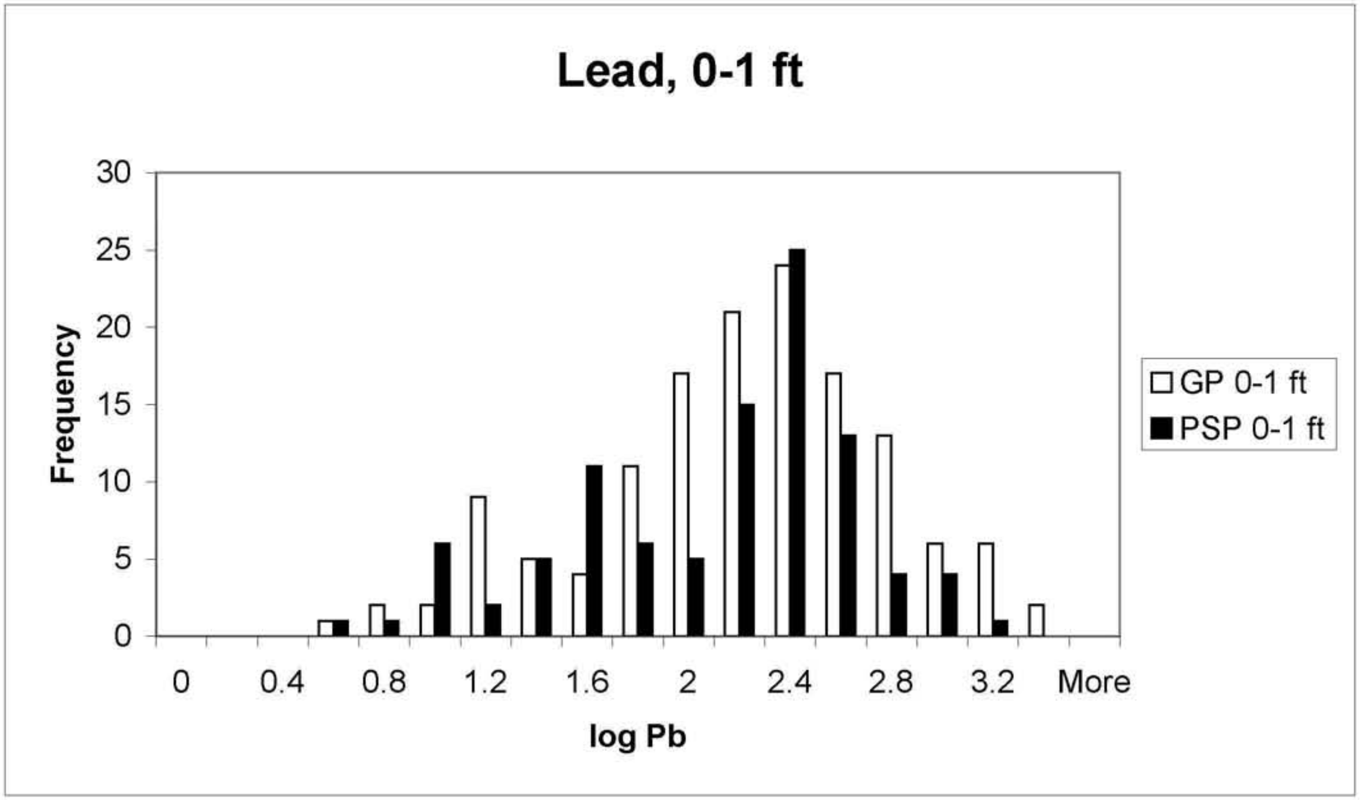
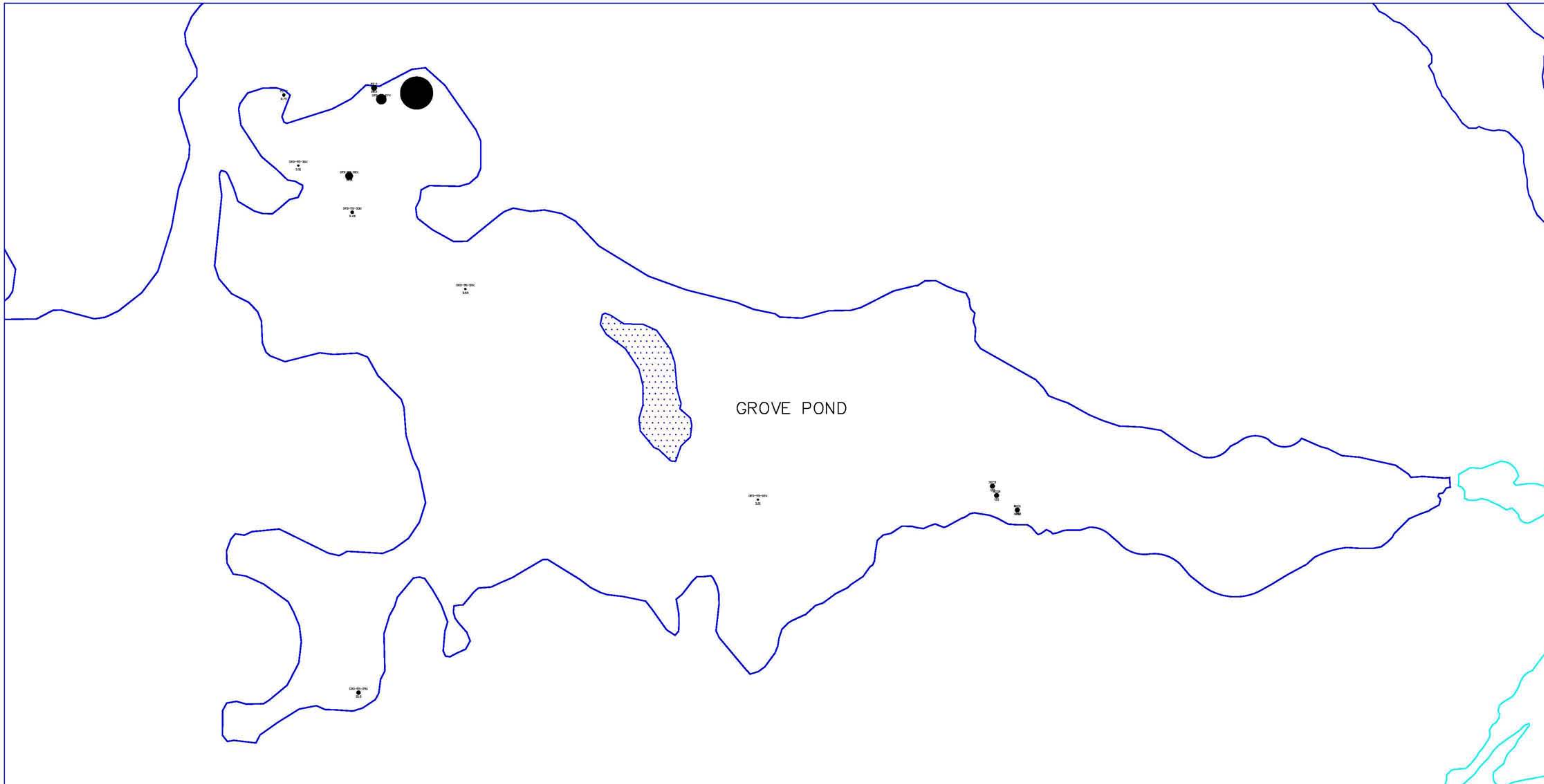


FIGURE NO.: FIGURE 5-27		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF LEAD CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a lead concentration of 1,000 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

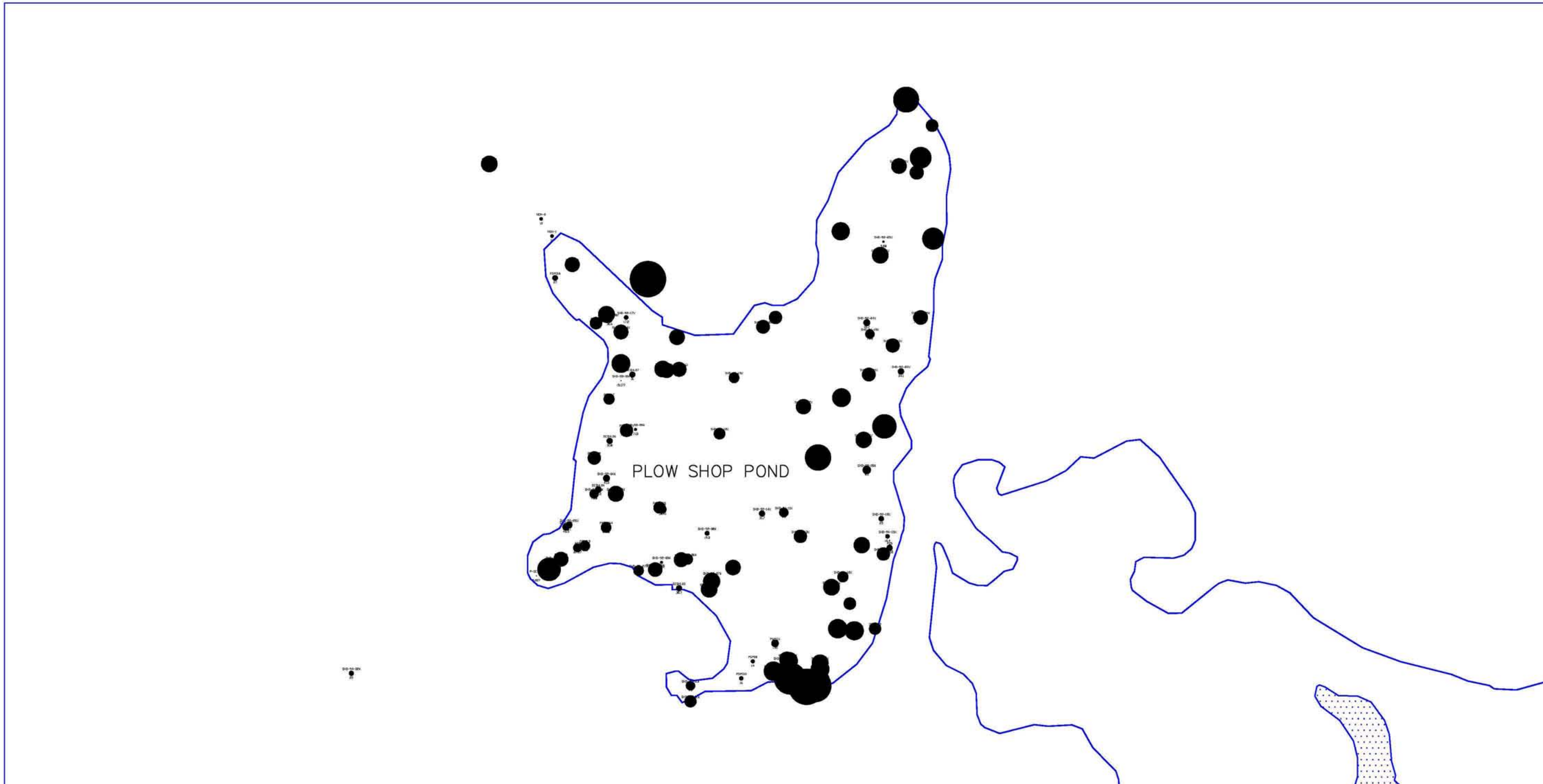
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

LEAD IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC. 2005	5-28

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a lead concentration of 1,210 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

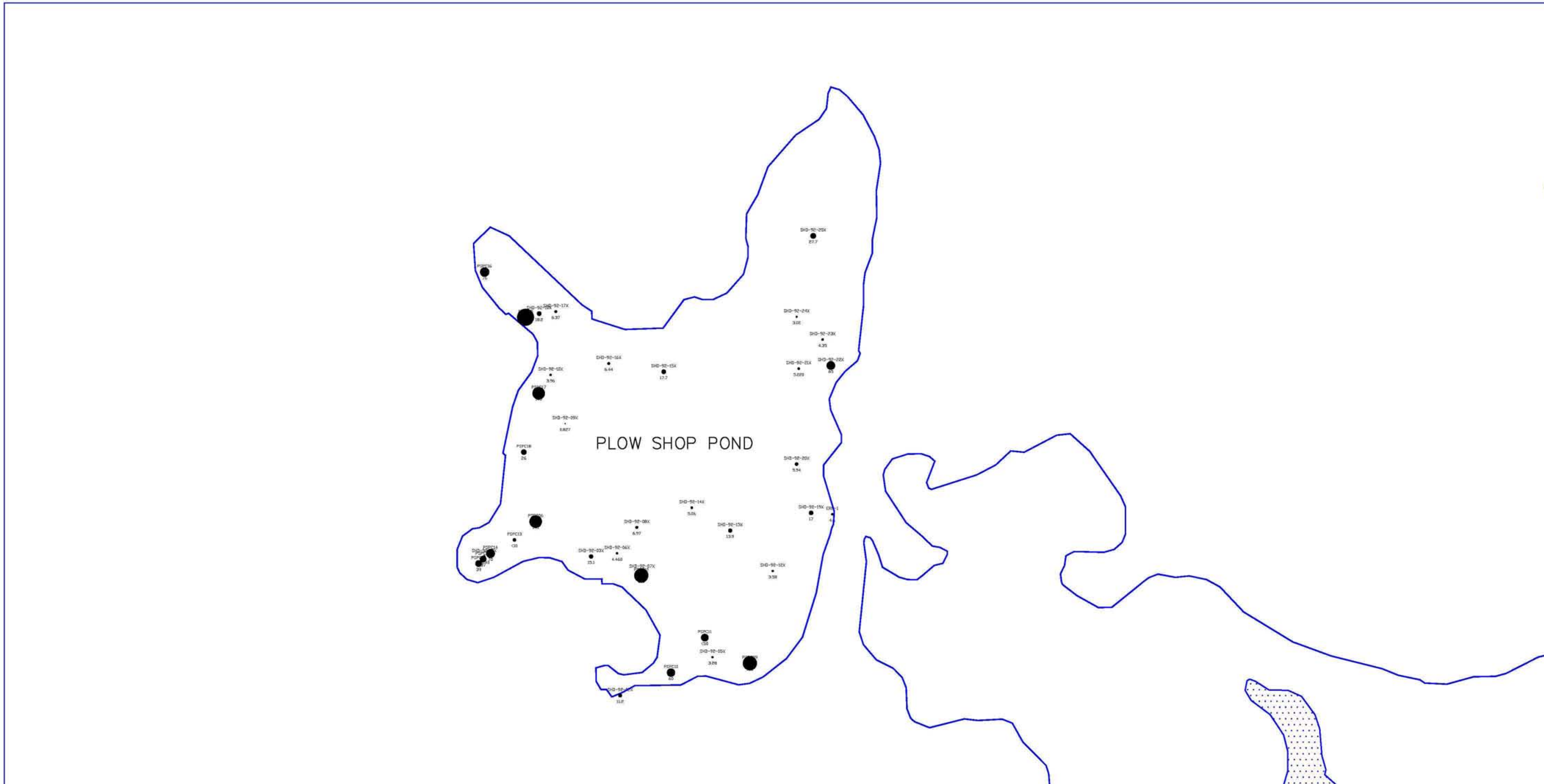
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

LEAD IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5–29

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a lead concentration of 260 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

LEAD IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5-30

Gannett Fleming

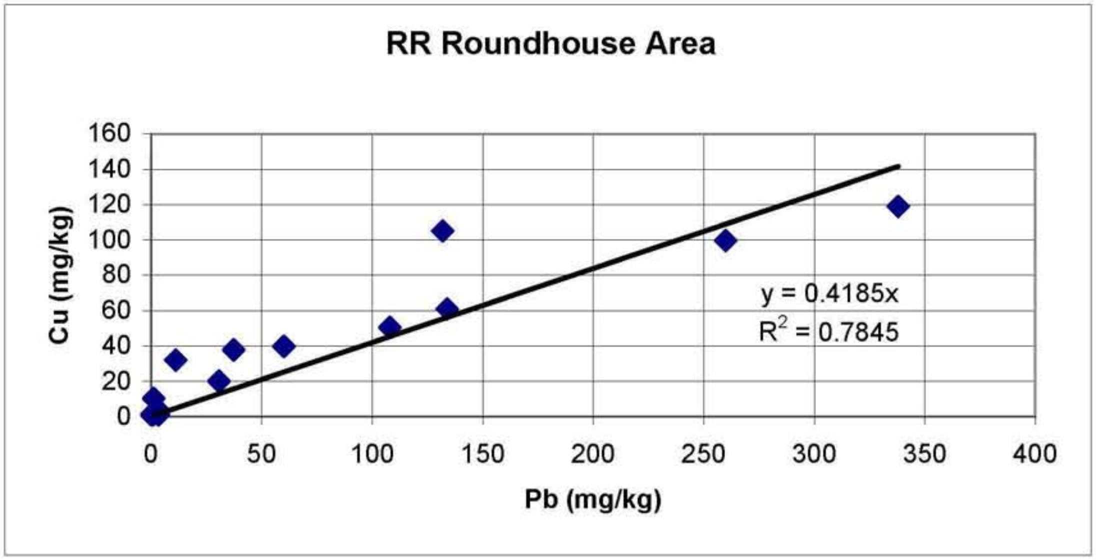


FIGURE NO.: FIGURE 5-31		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
COPPER vs. LEAD IN SHALLOW SEDIMENT ADJACENT TO THE RAILROAD ROUNDHOUSE 0 -1 FOOT BELOW GRADE		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

Figure 5-32. Shallow Groundwater Elevations, Nov. 15, 2004.

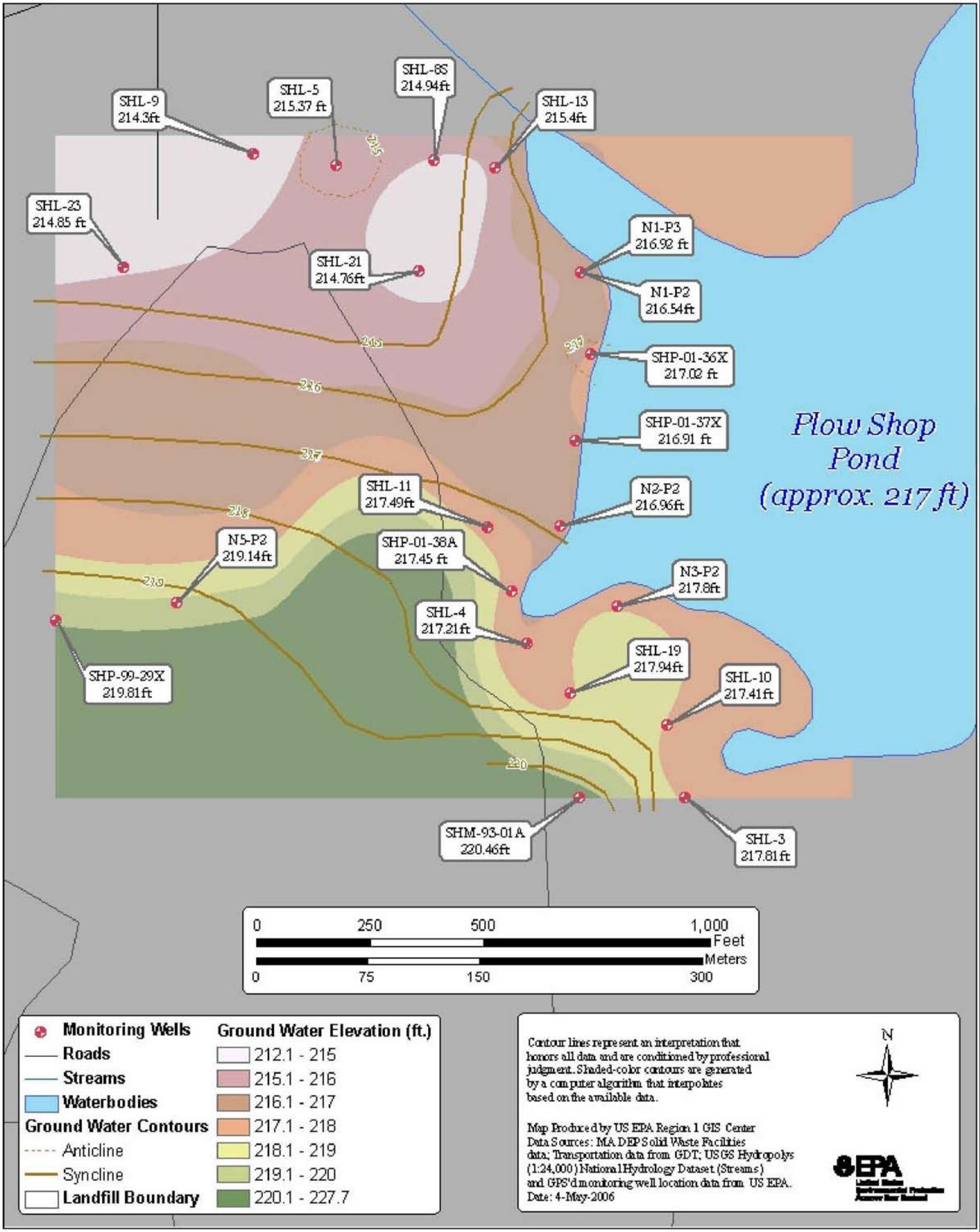
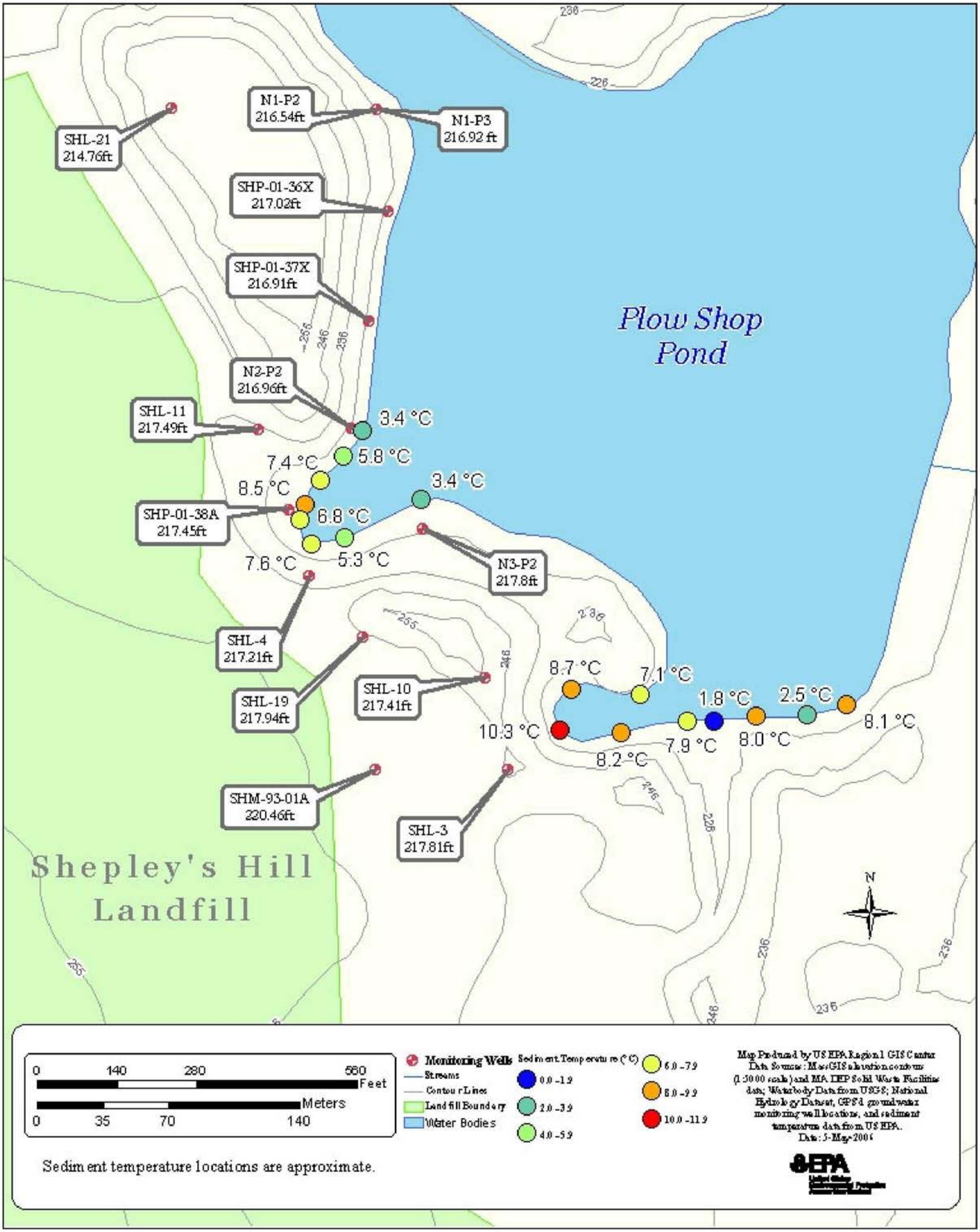


Figure 5-33: Shallow (1 ft) Sediment Temperature



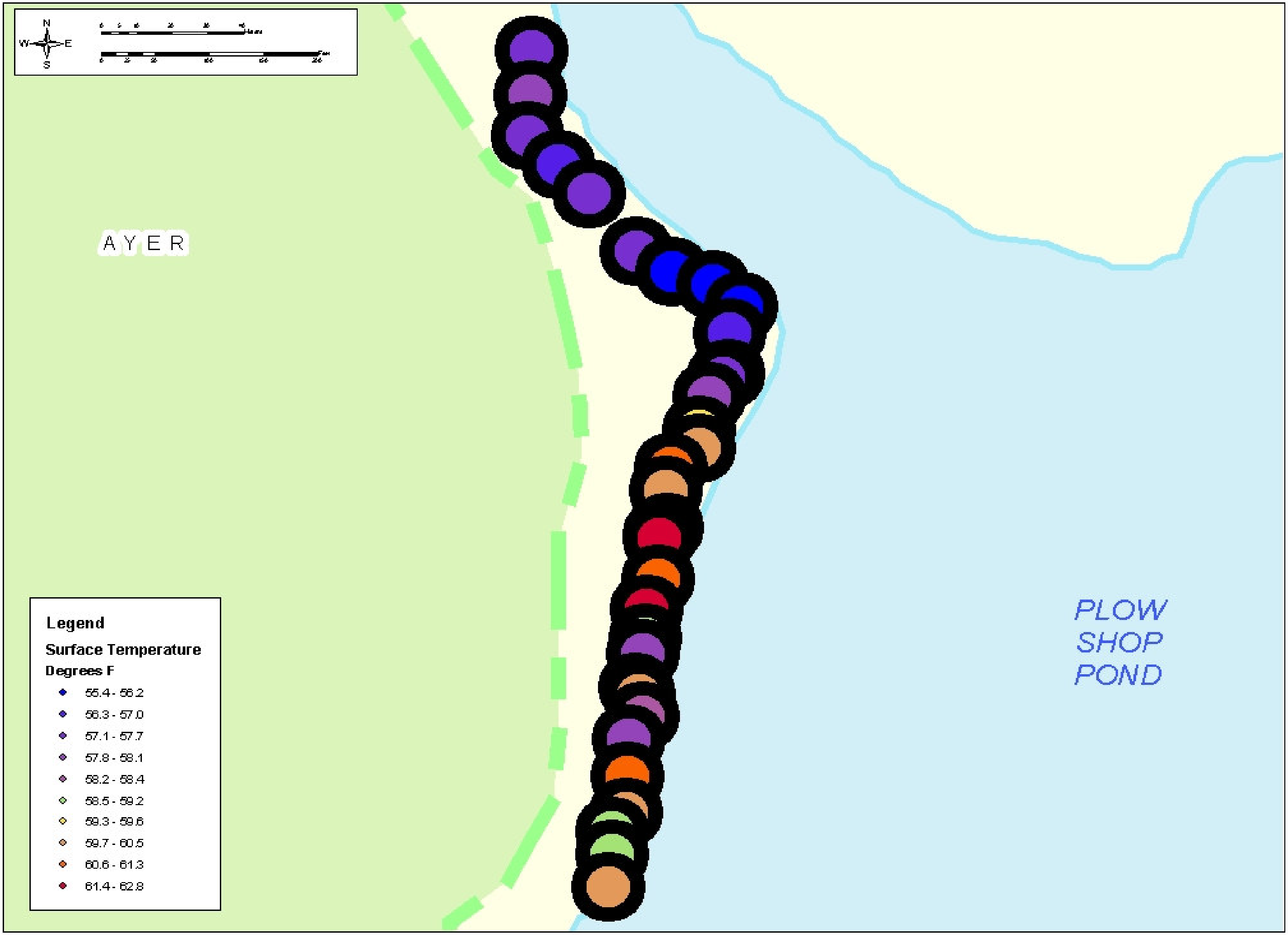


Fig. 5-34: Sediment temperature 1 ft below water-sediment interface, April, 2005 (EPA, 2005, unpublished).

APPENDIX A

LIST OF DATA SOURCES

List of Data Sources
Grove Pond and Plow Shop Pond ESI

Notations:

[1] GF/Newton
[2] BRAC Library
[3] GF/NH

1. February 1985. *21E Site Assessment, Bligh Street, Ayer, Massachusetts*. IEP, Inc., (Northborough, MA). Six test pits were excavated on the former tannery property. Groundwater and soil samples were analyzed for inorganics; Ba, Hg, Pb, Se, and Cr were found to be in excess of MCLs in groundwater; As, Ba, Cu, Hg were elevated in soil (Cr was not analyzed).

[1] [2]

2. April 1993. *Final Remedial Investigation Report for Areas of Contamination 4, 5, 18, 40, Fort Devens, Massachusetts.* Prepared for the U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland by Ecology and Environment, Inc. (E&E). RI at Fort Devens Group 1A Sites. Surface water and sediment samples were collected from Plow Shop Pond and analyzed for VOCs, pesticides, and inorganics. Chloroform and methylene chloride were found in several water samples; Cu, Ag, Zn exceeded Ambient Water Quality Criteria (AWQC). Sediments were analysed for organics, metals, and TOC, and were found to be high in metals; low concentrations were reported for PAHs and VOCs. Two sediment-water sample pairs were collected from the Nonacoicus Brook wetlands. The surface water inorganics were similar to concentrations in Plow Shop Pond surface water; sediments did not report unusually high inorganics.

[1] [2]

3. January 1993. *Town of Ayer, Massachusetts Grove Pond Wells Hydrogeologic Investigation and Zone II Aquifer Mapping*. Camp Dresser & McKee Inc. Contains MODFLOW results from May 1992 and Sept. 1992 pump tests; Zone II delineation; sensitivity analysis; water budget; conceptual hydrologic model; particle track simulation; groundwater chemistry for 3 sampling events during pump test in September 1992.

[1] [3]

4. June 1993. *UST Closure Report, New England Telephone Company Garage, Sandy Pond Road, Ayer, MA.* Prepared by EnviroTEL, Inc. for New England Telephone, Boston, MA. This site is too distant to have an impact to the study area.

[1]

5. September 1993. *Concentrations of mercury and other environmental contaminants in fish from Grove Pond, Ayer, Massachusetts*, US Fish and Wildlife. Fish filets from Grove Pond were analyzed for inorganics that included Hg, Cr, As, Pb, and PCBs. Four samples exceeded World Health Organization limits for Pb; one sample exceeded FDA action level for Hg, and low PCBs were found in some.

[1] [2]

6. December 1993. *Final Remedial Investigation Addendum Report, Data Item A009. Vol. I of IV, Report Text.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

   Collected supplemental samples from Plow Shop Pond, Nonacoicus Brook Wetland, and Grove Pond to fill identified data gaps; also discusses data from Plow Shop Pond, Shepley's Hill Landfill, Cold Spring Brook Landfill, New Cranberry Pond, and Nonacoicus Brook wetlands.

   Grove Pond: Data from five surface water and five surface sediment samples; analytes included PAL VOCs, SVOCs, pesticides, PCBs, explosives, inorganics. No organics were reported; highest concentrations of inorganics, including As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, and Zn, were found in sediments from the pond's northwest corner. Of these, As, Cr, Cu, Pb, Pb, and Hg were found to be in excess of the Ontario Sediment Guidance (OSG) Serious Effect Level.

   Plow Shop Pond: 68 sediment samples at 25 locations. Analytes included inorganics, pesticides, PCBs, TOC. Concluded that Plow Shop Pond sediments are contaminated with As, Ba, Cr, Cu, Fe, Pb, Mn, Hg, Ni, and Zn. The former tannery, Shepley's Hill Landfill, and former railroad roundhouse were identified as probable contributors. A fish community study, fish tissue contaminant study, and macroinvertebrate studies were also conducted as part of supplemental RI.

   Nonacoicus Brook Wetland: surface soil and shallow groundwater samples taken from four shallow, hand-dug pits immediately north of SHL. Analyzed for VOCs, pesticides, PCBs, explosives, and inorganics. No PAL organics reported from groundwater, but Ba, Ca, K, Mn, Pb, and Zn were contaminants in groundwater. In soils, no VOCs, PCBs, or explosives were reported; low concentrations of DDE and DDT. 20 PAL inorganics detected, concentrations of 16 exceeded background levels at least once. Be, Cr, Cu, Hg, Ag, Zn considered contaminants in soil samples; Cr and Hg highest near Nonacoicus Brook.

   Railroad roundhouse area: three shallow soil samples and one pond sediment sample; some low concentrations of SVOCs, and elevated levels of As, Sb, Cu, and Pb.

   Vol. II of IV, Appendix A-G.

   Vol. III of VI, Appendix H. Laboratory QC results.

Vol. IV of IV, Appendices I-Z. Contains background Devens soil and groundwater concentrations (metals); RI sediment summaries (Shepley's Hill and Cold Spring Brook Landfills).

[1] [2] [3]

7. March 1994. *Interim Comprehensive Site Assessment, Ayer Municipal Landfill, Groton – Harvard Road Volume 1* – Text

   Volume II – Round 1 sampling results - DEP did not have

   Volume III – Round 2 sampling results did not get section 4.

[1]

8. April 1994. *Site Assessment Report, Boston & Maine Railroad Property, Fort Devens, Ayer, Massachusetts*. Prepared by ERM for Boston & Maine Corporation. During this investigation of the Hill Yard for Guilford Transportation, 8 groundwater-monitoring wells were installed, and soil and sediment samples were taken from Grove Pond adjacent to the Yard. Results from groundwater and soil samples did not pose any problems, but elevated levels of As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn were found in sediment.

[1]

9. June 1994, *Sampling and Analysis Report, Bligh Street Facility*. Green Environmental. Surface soil sampling and metals analysis at tannery site in response to a January 1994 NOR. 30 surface soil samples but no analytes found (samples were from fill after the 1961 fire).

[1]

10. October 1994. *Final Railroad Roundhouse Supplemental Site Investigation Work Plan, Data Item A004.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

    This document contains March 1993 surface soil sampling results (organics, pesticides, inorganics, TOC).

[3]

11. December 1, 1994 (October 1994), *Grove Pond Field Investigation*. Prepared by Metcalf & Eddy for MADEP. Six Grove Pond surface water and sediment samples were collected; surface water was analyzed for VOCs, SVOCs, pesticides/PCBs, TAL metals, suspended and dissolved solids, and hardness. Sediments were analyzed for VOCs, SVOCs, pesticides/PCBs, TAL metals, TOC, grain size, and percent solids. Low levels of some pesticides were found, and As, Cd, Cr, Cu, Pb, and Hg exceeded Ontario Sediment Guidance (OSG) criteria.

[1]

12. December 1994. *Phase I – Initial Site Investigation Plastic Distributing Corporation, Bligh Street Facility, Ayer, MA. Quincy, MA.* Green Environmental, Phase I investigation of the tannery site. Four soil borings were

taken during the installation of four shallow monitoring wells between the filled-in cove and the former tannery site, and five subsurface soil samples were collected from borings in the same area. Elevated concentrations of metals were found in soil, and both metals and organics were found in groundwater (TPH, As, Ba, Cr, Pb, Hg in soil; As, Cr, Pb, Hg, xylene, TCE in groundwater).

[1] [2]

13. February 1995. *Final Feasibility Study: Shepley's Hill Landfill Operable Unit, Data Item A009.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

    This study includes discussion and analysis of remedial alternatives, summary of groundwater modeling results.

[1] [3]

14. February 1995. *Final Grove Pond Site Investigation Work Plan, Data Item A004.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

    Tabulated data from Dec. 93 RI are contained in this document.

[1] [3]

15. February 1995. *Final Feasibility Study Shepley Hill Landfill.*

[1]

16. April 1995. *RAO Statement and Supporting Documentation.* Prepared by Handex of NE, Inc. for NYNEX, Boston, MA.

[1]

17. April 1995. *Lower Cold Spring Site Investigation Data Package.*

    The December 1995 report updates this report

[1]

18. May 1995. *Detailed Flow Model for Main and North Post, Fort Devens, Massachusetts.* Prepared by Engineering Technologies Associates, Inc. (ETA) for commander, US Army Toxic and Hazardous Materials Agency. Ellicott City, Maryland.

    This report documents a numerical model for the basewide groundwater hydrology, including a Zone II delineation for the Devens Grove Pond water-supply wells.

[3]

19. June 1995. *Final Delivery Order Work Plan: Predesign Investigations, Areas of Contamination (AOCs) 4, 5, and 18, Shepley's Hill Landfill, Fort Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

[3]

20. September 1995. *Railroad Roundhouse Supplemental Site Investigation, Data Item A009.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

    Four shallow sediment samples were collected for confirmation of the 1993 data. In addition, 46 shallow soil samples were taken from 15 test pits and analyzed for SVOCs, inorganics, and TOC. Two new water-table monitoring wells were installed downgradient of the roundhouse, and two rounds of sampling two existing and the two new wells were conducted. Analytes included SVOCs and total and dissolved metals.

    In sediment data, low levels of 13 SVOCs were reported. In addition, exceedances of sediment criteria for As, Cr, Cu, Fe, Pb, Hg, Ni, and Zn were found; it was concluded that disposal of maintenance by-products near pond was responsible for elevated Sb, Cu, and Pb. Soils from the maintenance by-products disposal area also reported As (barely), Ba, Cr, Cu, Pb, V, Sn, Zn higher than background. Concentrations of inorganics from soil samples taken near the railroad roundhouse and turntable area were not exceptionally high in comparison to background values. Groundwater samples did not indicate evidence of site-related contamination. Preliminary Risk Evaluations indicated potential risk to human health and to ecological receptors due to SVOCS and the presence of elevated levels of inorrganics (Sb, As, Cu, Pb, and Sn) in soils and near-shore sediments. The observed levels of Sb, Cu, and Pb are attributed to disposal of maintenance by-products. It is noted that the Army uses site-specific background concentrations to evaluate contamination at the roundhouse site, according to the Massachusetts Contingency Plan (MCP) definition of "background," which includes "…fill materials containing…coal ash." The MCP definition thus precludes the identification of elements uniquely attributable to coal ash as COPCs.

[1] [3]

21. October 1995. *Draft Plow Shop Pond and Grove Pond Sediment Evaluation, Data Item A009.* Prepared by ABB Environmental Services, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

    Vol. I, Sections 1.0 - 8.0. Summary of previous risk assessments; toxicity testing; and field investigation results: Grove Pond sediments (SVOCs, pesticides, PCBs, metals, Hg, TOC), surface soils and surface waters; Plow Shop Pond sediments (metals, pH, TOC, Hg), pore water (metals, Hg), and acid-volatile sulfides and simultaneously extracted metals.

Analyses are reported for 65 sediment samples from 48 locations at Grove Pond; 71 sediment samples from 28 locations in Plow Shop Pond. Grove Pond sediment samples reported exceedances of As (up to 1300 μg/g), Cr (47000 μg/g), Pb (up to 1760 μg/g), and Hg (220 μg/g). The Preliminary Risk Evaluation (PRE) conducted by Army at that time reported that these four metals exceeded human health screening values.

Vol. II, Appendices A-M: details of toxicity testing, water quality parameters, grain size analysis, data quality evaluation.
[1] [3]

22. December 1995. *Draft Long Term Monitoring and Maintenance Plan, Shepley's Hill Landfill, Fort Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

Establishes baseline concentrations in downgradient groundwater (VOCs and inorganics, data in Appendix B); data are from RI sampling in Aug. and Dec. 1991 and supplemental RI sampling in March and June 1993.
[3]

23. December 1995. *Monitoring Well Installation Final Work Plan: Shepley's Hill Landfill Areas of Contamination (AOCs) 4, 5, and 18, Fort Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.
[3]

24. December 1995. *Lower Cold Spring Brook Site Investigation Report*, Data Item A009, prepared by ABB-ES for US Army.
[1] [2]

25. March 1996. *Groundwater Model Update Report, Predesign Investigations, Areas of Contamination (AOCs) 4, 5, and 18, Shepley's Hill Landfill, Fort Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

Contains revisions to previous MODFLOW results, boring logs, slug test results, daily reports.
[3]

26. March 1996. *Close out Report – Shepley Hill Landfill.*
[1]

27. January 1997. *1996 Annual Report – Shepley Hill Landfill.*
[1]

28. January 1997. Letter Report: Revised Zone II Delineations for Devens Water Supply Wells. January 20, 1997. From Earth Tech to A. Delaney, Municipal Engineer.

    Modified previous Zone II delineation (determined from MODFLOW results)

[3]

29. June 1997. *Hartnett Tannery Site, Ayer, Middlesex County, Massachusetts Site File*. Prepared by Roy F. Weston, Inc. for EPA. Soil samples were collected from 19 pits on PDC property. Findings included PCBs (110 mg/kg) in one pit; also, As, Cr, Cu, Pb, Hg, Ni, V, and Zn were reported above background concentrations in one or more samples. Maximum values reported for these elements are: As, 5520 mg/kg; Cr, 18000 mg/kg; Cu, 2560 mg/kg; Pb, 618 mg/kg; Hg, 4.3 mg/kg, Ni, 50.6 mg/kg, V, 161 mg/kg; and Zn, 867 mg/kg.

[1]

30. August 1997. Data reported to Massachusetts DEP. PDC Surficial Soil Sampling: EPA 24 surface soil samples were collected and analyzed for metals and PCBs. No PCBs reported, and metals appeared to be low except for one sample.

[1]

31. August 1997. Data reported to Massachusetts DEP. Town of Ayer Grove Pond water-supply well sampling by the Ayer Department of Public Works. Raw water was sampled but found to contain no inorganics exceeding MCLs.

[1]

32. December 1997. *Plow Shop Pond and Grove Pond Ecological Impact Evaluation, Fort Devens, Massachusetts*. Prepared by TRC Environmental Corporation for MADEP. TRC conducted an ecological evaluation of Grove Pond and Plow Shop Pond and concluded that metals concentrations in sediments would likely impact ecological receptors.

[1]

33. February 1998. *Draft Five Year Review: Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

    Contains groundwater-monitoring results: groundwater elevations for 5 years; chemical data only for spring and fall 1997.

[3]

34. April 1998. Memo to J. Regan (MADEP) from S. Heim (TRC ecologist), Review of AVS/SEM Sampling Results, Grove Pond Sediment, Fort Devens, Massachusetts. Ten sediment samples from Grove Pond were collected and analyzed for acid-volatile sulfide and simultaneously extractable metals (AVS/SEM). All samples exceeded sediment criteria for Cr, and five samples

exceeded criteria for Pb. Samples with the highest metals concentrations came from locations near the tannery site, e.g. Cr at 24931 mg/kg; Pb at 437 mg/kg.
[1] [2]

35. August 1998: ATSDR consultation for Fish and Sediments. ATSDR concluded that residents of the Town of Ayer are not at risk due to limited exposure. A fish advisory went into effect, and Grove Pond was posted “Catch-and-Release.”
[2]

36. August 1998. *Final 5 year Review- Shepley Hill Landfill.*
[1]

37. August 1998. *Evaluation of Health Concerns Associated with Drinking Water from Grove Pond Wells, Fort Devens, Ayer, Middlesex County, Massachusetts.* US Department of Health and Human Services, Public Health Service, ATSDR. In this consultation regarding groundwater from the Town of Ayer Grove Pond water-supply wells, ATSDR concluded that residents of the Town of Ayer are not at risk of exposure to harmful levels of metals from the water-supply wells, and future problems were not anticipated.
[2]

38. November 1998. *Surface Water & Sediment Sampling Fort Devens Superfund Site Ayer, MA.* Submitted to EPA by ESAT.
[1]

39. 1999. *USEPA Screening Level Ecological Risk Assessment, Fort Devens, Ayer, Massachusetts.* USEPA, Region 1 New England, Office of Environmental Measurement and Evaluation.

    Surface water and sediment samples were collected from Grove Pond, Plow Shop Pond, and Nonacoicus Brook.
[1] [3]

40. October 21, 1999. *Field Work and Analytical Results, PDC, Ayers.* Environmental Compliance Services (ECS) installed 5 MWs & 2 seepage meters at the PDC site (RTN 2-10138) and summarized the investigation in a memo format. Unknown if the investigation was performed for DEP or for privately. Included in the memo is: soil descriptions, gw elevations & analytical results for metals, PCBs, pesticides, EPH & SVOCs.
[1]

41. July 2000. *Phase II Subsurface Investigation, One Bligh Street, Ayer, Massachusetts.* Prepared for Nextel Communications by Sage Environmental. Two soil borings were sampled during installation of two groundwater-monitoring wells. Groundwater was analyzed for EPH, VOCs, PCBs, and 13 metals. Soils exceeded MADEP Method 1, S-2 standards for As and Hg. In groundwater, exceedances of the MCP Method 1, GW-2/GW-3 standard for Pb were found.

[1] [3]

42. July 2000. *Draft Shepley Hill Landfill Supplemental Groundwater Investigation.*

[1] [2]

43. September 2000. *Limited Environmental Investigation, Plastic Distribution Company, One Bligh Street, Ayer, Massachusetts.* Prepared by Environmental Compliance Services, Inc., for MADEP.

    MADEP Phase II investigation of Hartnett Tannery was completed in September 2000. Data from surface water, sediments, monitoring wells, soil borings, piezometers, and seepage meters are reported.

[1] [3]

44. September 2000. *Trace Element Exposure in Benthic Invertebrates from Grove Pond, Plow Shop Pond, and Nonacoicus Brook, Ayer, Massachusetts*. Prepared by US Fish and Wildlife Service for USEPA in response to a request by EPA for a limited screening-level contaminant study of mussels and crayfish. The investigators found As, Cd, Cr, and Hg in all mussel samples, and Hg in 9 samples out of 12. In crayfish, As, Cd, Hg, and Pb were not found to be elevated compared to results reported in scientific literature.

[1] [3]

45. September 2000. *RAM Plan for 30 Faulkner Drive, Ayer, MA.* Prepared by ENSTRAT Strategic Environmental Services for MADEP.

[1]

46. January 2001. *Data Report, Metals in Frog Tissue*. U.S. EPA Office of Environmental Measurement and Evaluation, Lexington, MA. February 2001.

    Frog tissue analyses are reported.

[1]

47. January 2001. *Study Area 71 Former Railroad Roundhouse Site, Various Removal Actions-Phase II, Devens, Massachusetts.* Prepared by Roy F. Weston for the U.S. Army Corps of Engineers.

    This is the final closure report. Under a separate report, the U.S. Army intends to perform a site-specific risk evaluation to support a No Further Action Decision.

[1] [2] [3]

48. April 2001. *Final Report Bioavailability and Potential Effects of Mercury and Selected Other Trace Metals on Biota in Plow Shop and Grove Ponds, Fort Devens, Massachusetts.* Prepared by T. A. Haines and J. R. Longcore (USGS) for EPA.

Analyses of surface water, sediment, invertebrates, tree swallow tissues are reported.

[1]

49. April 2001. *RTC on Draft Shepley Hill Landfill Supplemental Groundwater Investigation*

[1]

50. May 2001. *Shepley Hill Landfill Long Term Monitoring and Maintenance – 2000 Annual Report.* Includes RTC on 1999 Annual Report.

[1]

51. August 2001. *Paleolimnological Assessment of Grove and Plow Shop Ponds, Fort Devens, Ayer, Massachusetts.* Prepared for USEPA by Norton, S.A. (University of Maine).

In this study, cores from Grove, Plow Shop, and Spectacle Ponds were analyzed for stable Pb isotopes, and As, Cd, Cr, Hg, Ni, Pb, and Zn content. Conclusions state that high accumulation rates and elevated concentrations in Grove and Plow Shop Ponds indicate anthropogenic impact. The report also concluded that As is entering Plow Shop Pond from the southwestern side; Cd, Ni, Pb, and Zn enter the system from the eastern end of, or upstream of, Grove Pond; and Cr, Cu, and Hg come from the Tannery cove of Grove Pond.

[1] [3]

52. August 2001. *Semi-Annual Groundwater Analytical Data Report, Spring 2001, Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts.* Prepared by Department of Army New England District, Corps of Engineers, Concord, Massachusetts

[1] [2]

53. January 2002. *Draft No Further Action Decision Under CERCLA, Study Area 71, Railroad Roundhouse, Devens Reserve Forces Training Area, Devens, Massachusetts.* Prepared for U.S. Army Corps of Engineers by Harding ESE, Inc..

In this study, the human health & ecological risk evaluation is included.

[1]

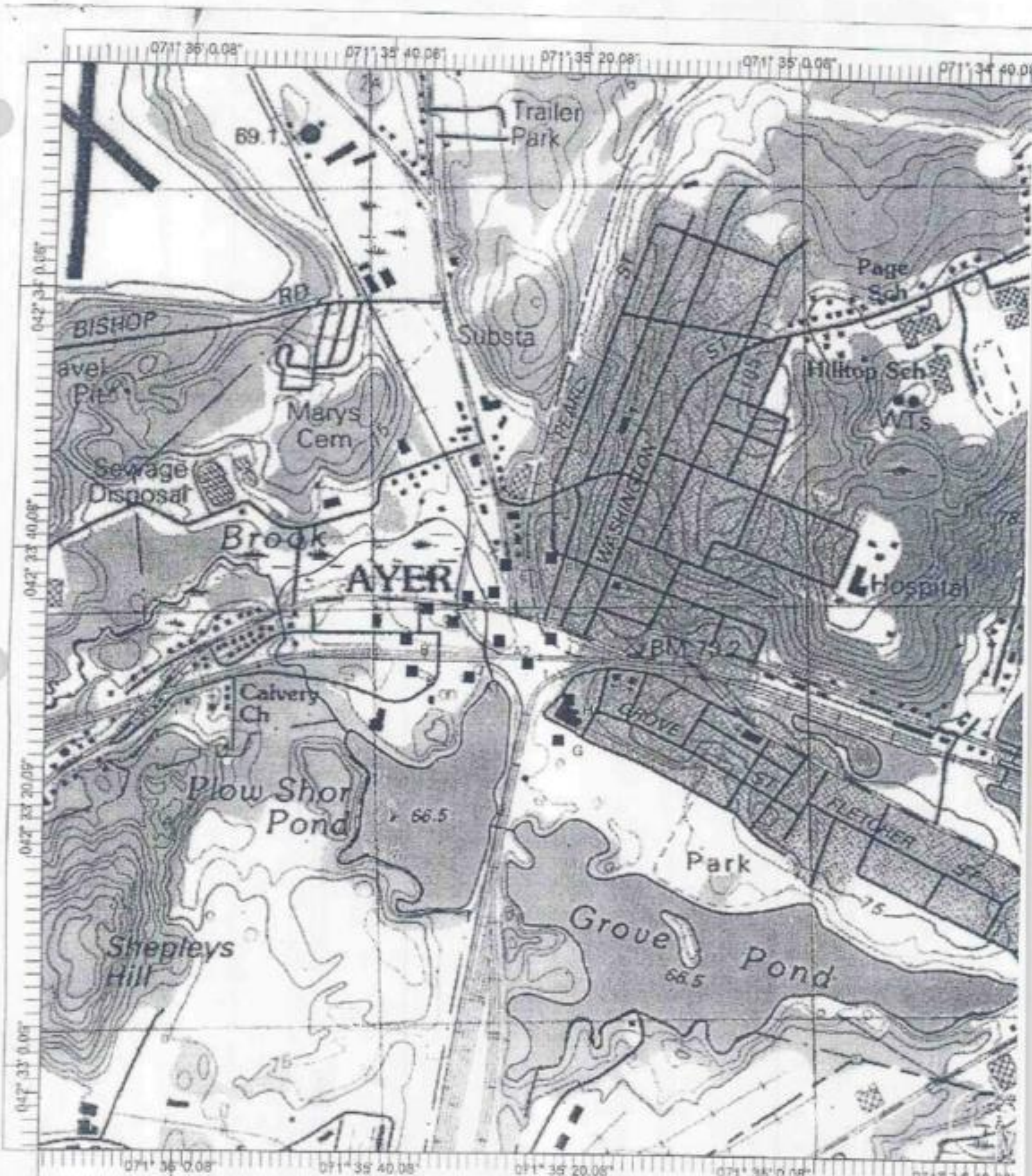
54. February 2002. *Revised Draft Shepley's Hill Landfill Supplemental Groundwater Investigation, Devens Reserve Forces Training Area, Devens, Massachusetts.* Prepared for U.S. Army Corps of Engineers by Harding ESE, Inc. – 2 volumes

[3]

55. May 1999 *Phase I Work Plan* through March 2002 *Grove Pond Arsenic Investigation* --- Phase I report (GF, 1999) includes data for metals, anions and alkalinity, and water quality parameters from 68 groundwater samples. Phase I activities involved only the Town of Ayer production wells, which were added to the Town water-supply system in July 1998; four existing monitoring wells (installed for a pump test in 1992) screened at the production horizon; two existing monitoring wells on MNG property; and eight surface water samples from Grove Pond. Arsenic was detected at low levels (< 10 μg/L) in surface waters and in the production wells at levels of ~20 to 30 μg/L. Phase II (GF, 2002) installed five new monitoring wells, with screen depths varying from the top of the water table to within bedrock. Close-interval sampling of soil and groundwater was conducted during installation of three of these monitoring wells and from a borehole in the pond, offshore from the production wells. Hydraulic characteristics were determined from slug tests performed during well installation and from grain-size analyses. Results show marked heterogeneity in the aquifer. Conductivity is generally lower in the upper 40 feet of the aquifer, due to higher silt content, and higher through the sand-gravel interval in which the Town wells are screened. Groundwater chemistry is also consistent with the hydraulic properties of the aquifer. The upper ~40 feet are characterized by low oxidation-reduction potential (ORP); below ~45 feet, ORP is positive (through the screened interval) but becomes reducing again near and into bedrock. Dissolved arsenic increases with depth in the upper 40 feet, to a maximum of 189 μg/L around 45 feet below ground surface, and drops to levels near detection limits below this depth. The correlation between groundwater ORP, arsenic, and iron points strongly toward reductive dissolution of ferric oxyhydroxide coatings on aquifer material, with subsequent release of sorbed constituents, as the mechanism responsible for the observed arsenic in the Town wells. The ultimate arsenic source has been tentatively attributed to arsenic-bearing sulfide minerals (pyrite and cobaltite), which have been identified in samples of bedrock from beneath these wells. Glacial and post-glacial physical and mechanical weathering of these sulfide phases is postulated to have resulted in the present-day distribution of arsenic and other metals through the aquifer.

56. Data from U.S. EPA investigations in 2004 and 2005. Grove Pond data included 6 surface water samples (total and dissolved metals, pesticides/PCBs), 15 sediment samples (metals), 3 sediment samples (metals, pesticides/PCBs, and PAHs), 4 fish samples (metals and pesticides/PCBs), and toxicity data for surface water invertebrates, benthic invertebrates, and fish. Plow Shop Pond data included 10 surface water samples (total and dissolved metals, pesticides/PCBs),

28 sediment samples (metals), 11 sediment samples (metals, pesticides/PCBs, and PAHs), 4 fish samples (metals and pesticides/PCBs), and toxicity data for surface water invertebrates, benthic invertebrates, and fish. Flannagan Pond data included 1 surface water sample (total and dissolved metals, pesticides/PCBs), 2 sediment samples (metals, pesticides/PCBs, and PAHs), 3 fish samples (metals and pesticides/PCBs), and toxicity data for surface water invertebrates, benthic invertebrates, and fish.



<Default> - 16 Markers. Length = 1 mile, 2638 feet

H - 042° 33' 29.0" N, 071° 35' 20.4" W
G - 042° 33' 28.7" N, 071° 35' 21.4" W
A1 - 042° 33' 30.6" N, 071° 35' 30.8" W
A2 - 042° 33' 33.4" N, 071° 35' 27.8" W
B - 042° 33' 33.4" N, 071° 35' 37.3" W
C - 042° 33' 35.8" N, 071° 35' 35.1" W
E - 042° 33' 38.2" N, 071° 35' 27.2" W
F - 042° 33' 39.9" N, 071° 35' 22.5" W
1 - 042° 33' 31.7" N, 071° 35' 24.7" W
1 - 042° 33' 31.7" N, 071° 35' 24.7" W
I - 042° 33' 34.8" N, 071° 35' 32.6" W
J - 042° 33' 33.7" N, 071° 35' 22.4" W
K - 042° 33' 30.9" N, 071° 35' 36.7" W
D2 - 042° 33' 36.8" N, 071° 35' 21.1" W
D - 042° 33' 37.2" N, 071° 36' 28.4" W

Name: AYER
Date: 11/9/101
Scale: 1 inch equals 1000 feet

Location: 042° 33' 35.4" N 071° 35' 23.9" W

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1949 SANBORN MAP

1: B&M Rail Road Passenger Station and freight house located to the east-northeast of Plow Shop Pond.

A1: G.V. Moore Lumber Company located to the northwest of Plow Shop Pond, property abuts the ponds edge.

A2: G.V. Moore Lumber Company located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of a tributary draining into Plow Shop Pond.

B: Cabinet Manufacturer located to the northwest of Plow Shop Pond on Shirley Street.

C: Plastic Goods Storage located to the northwest of Plow Shop Pond on Mechanic Street.

D: E.O. Proctor Garage (repair shop) with attached movie theater to the north and photo shop to the east. Located to the north of Plow Shop Pond along the north side of West Main Street along the east bank of an un-named tributary draining into Plow Shop Pond.

E: Coal Yard Farm Service Company located to the north of Plow Shop Pond.

F: Chandler Machine Company located to the northeast of Plow Shop Pond.

G: Ayer Tanning Company, Inc. located to the east of Plow Shop Pond and north of Grove Pond.

H: International Purchasing Company Rope Storage. North of the tannery on Bleigh Road facility consists of three main buildings including a paper pulp storage building.

J: Paint Tin Shop located to the north of Plow Shop Pond

K: Vacant

*The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1921 SANBORN MAP

I: B&M Rail Road Passenger Station and freight house located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge.

A2: L. W. Phelps Wooden Box Factory – Lower Mill located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of an un-named tributary draining into Plow Shop Pond.

B: Data unclear on Sanborn Map but appears to have changed from a cabinet manufacturer to a wholesaler of some type.

C: ARMY YMCA Main Hall located to the northwest of Plow Shop Pond on Mechanic Street.

D: E.O. Proctor Garage (repair shop) in a plaza with a movie theater to the north. Located to the north of Plow Shop Pond along the north side of West Main Street along the eastern bank of an un-named tributary draining into Plow Shop Pond.

E: J. Cushing Coal Yard located to the north of Plow Shop Pond.

F: Unoccupied building "to be a machine shop".

G: Eugene Barry and Sons Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Ayer Machine Tool Company (not in operation) located north of the tannery on Bleigh Road.

K: Faye Phipps Company Wholesale Hardware.

* The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1912 SANBORN MAP

1: B&M Rail Road Passenger Station and freight house located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge.

A2: L. W. Phelps Box Factory – Lower Mill located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of an un-named tributary draining into Plow Shop Pond.

B: Vacant lot.

C: Vacant lot.

D: Small un-named garage and maintenance shop along the eastern bank of an un-named tributary draining into Plow Shop Pond.

D2: Fredrick Whitney Carriage House (with paint or print shop unclear on map).

E: A.E. Lawrence and Sons Coal Shop located to the north of Plow Shop Pond.

F: Vacant lot.

G: Eugene Barry and Sons Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Chandler Company Manufacturer of special machinery located north of the tannery on Bleigh Road.

I: Standard Oil Co. Depot south of Shirley Street.

J: Tobacco shop and restaurant on Merchants Way, north of Plow Shop Pond.

K: Hayhes Piper Company Cider Manufacturer located to the east of L.W. Phelps Lower Mill.

* The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1902 SANBORN MAP

* *The 1902 Sanborn Map shows Plow Shop Pond extending further north almost to the railroad tracks (prior to filling of the pond). This map also identifies the tributary leading to Plow Shop Pond from the north as Nanacanicus Brook.*

1: B&M Rail Road Passenger Station and freight house located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge (waste shed on the banks of the pond). Also, K + C Manufacturer Company – manufacturers wood rims for bicycles and automobiles building located to the east of L.W. Upper Mill.

A2: L. W. Phelps Box Factory – Lower Mill located to the north of Plow Shop Pond. This property lies along the eastern and western banks of Nanacanicus Brook. North of L.W. Lower Mill is E.O. Proctor Machine Shop and Bicycle Repair.

B: Fitchburg Rail Road Round House.

C: Vacant lot.

D: Vacant lot.

D2: Fredrick Whitney Carriage House.

E: Carriage Farm.

G: Eugene Barry and Sons Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Chandler Company, manufacturer of special machinery and Ayer Preserving Company located further north on Bleigh Street.

I: J. T. Pillman Preserve Co. located along the west side of Nanacanicus Brook.

* The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential. Also, the Nashoba Manufacturer of Dyelnc Mordant was located somewhere along the western banks of Plow Shop Pond (near a wooden bridge) the exact location could not be determined from the map.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1197 SANBORN MAP

** Both Plow Shop and Grove Ponds were identified on this map as Tannery Pond.*

1: B&M Rail Road Passenger Station with freight house and coal sheds are located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge (waste shed on the banks of the pond). Also, Chris H. Moulton Shoe factory was located to the east of L.W. Upper Mill.

A2: L. W. Phelps Box Factory – Lower Mill located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of Nanacanicus Brook.

B: Fitchburg Rail Road Round House.

C: Vacant lot.

D: Vacant lot.

D2: Fredrick Whitney Carriage House.

E: Carriage House.

G: Alley Brothers Place Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Ayer Foundry Company. Northeast of the foundry was Sigsbeen Company and E.O. Proctor Machine Shop all located north of the tannery on Bleigh Road.

I: Whitcher Pillman Company Preserves Manufacturer located along the west side of an un-named tributary to Plow Shop Pond.

K: W.J. Piper Company Vinegar Manufacturer.

* Area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential. Also, the Nashoba Manufacturer of DyeInc Mordant was located somewhere along the western banks of Plow Shop Pond (near a wooden bridge) the exact location could not be determined from the map.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1192 SANBORN MAP

**Both Plow Shop and Grove Ponds were identified on this map as Tannery Pond*

1: B&M Rail Road Passenger Station with freight house and coal sheds located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge (waste shed on the banks of the pond). Also, Chris H. Moulton Shoe factory was located to the east of L.W. Upper Mill.

A2: L. W. Phelps Lumber Yard located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of an un-named brook.

B: Fitchburg Rail Road Round House.

C: Vacant lot.

D: Vacant lot.

D2: Fredrick Whitney Carriage House.

E: Carriage House.

G: Alley Brothers Place Tannery located to the east of Plow Shop Pond and the north of Grove Pond.

H: D.L. G. H Chandler Foundry.

I: Vacant lot.

K: W.J. Piper Company Vinegar Manufacturer.

*Area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1187 SANBORN MAP

** Both Plow Shop and Grove Ponds were identified on this map as Tannery Pond and the tributary was identified as Moss Brook.*

1: B&M Rail Road Passenger Station with freight house and coal sheds located to the east-northeast of Plow Shop Pond.

A1: No coverage.

A2: L. W. Phelps Saw Mill and Ayer Furniture Company. These properties lie along the eastern and western banks of Moss Brook.

B: Fitchburg Rail Road Round House.

C: Vacant lot.

D: Vacant lot.

D2: Fredrick Whitney Carriage House.

E: Furniture Store.

G: Alley Brothers Place Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Briggs and Kelly Foundry and Machine Shop.

* The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

APPENDIX B
ANALYTICAL DATA

FINAL

HUMAN HEALTH RISK ASSESSMENT

GROVE POND AND PLOW SHOP POND

AYER, MASSACHUSETTS

May 2006

Prepared for:

USEPA Region 1
Contract EP-W-05-020 Task Order #01

Prepared by:

Gannett Fleming, Inc.
207 Senate Avenue
Camp Hill, PA 17011

TABLE OF CONTENTS

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (USEPA) directed Gannett Fleming, Inc. (Gannett Fleming) to prepare this Human Health Risk Assessment (HHRA) Report as part of the Grove and Plow Shop Ponds Expanded Site Investigation (ESI). This report is in response to the Task Order #01 to Contract EP-W-05-020, Remedial Oversight of Activities at Fort Devens Plow Shop and Grove Ponds. The objective of the human health risk assessment is to provide a quantitative estimate of risk posed to humans potentially exposed to Grove Pond and Plow Shop Pond. The location of this site is shown on Figure 1.

To assess potential public health risks, three major aspects of chemical contamination and exposure must be considered: 1) the presence of chemicals with toxic characteristics; 2) the existence of pathways by which human receptors may contact site-related chemicals; and 3) the presence of human receptors. The absence of any of these three aspects would result in an incomplete exposure pathway and an absence of quantifiable risk.

The human health risk assessment consists of five major components:

- Hazard Identification : Evaluate data usability, data quality and select contaminants of potential concern (COPC) (Section 2.0)
- Exposure Assessment: Identify potential receptor populations and completed exposure pathways. Determine exposure point concentrations for all COPCs, and present exposure equations and input parameters to be used to estimate chemical intakes (Section 3.0)
- Dose-Response Assessment: Identify chemical-specific toxicity criteria to be used for quantifying potential human risks. (Section 4.0)
- Risk Characterization: This section presents methods for calculating noncarcinogenic and carcinogenic risks for each receptor and provides summaries of the results of the site-specific risk evaluations. (Section 5.0)
- Uncertainty Analysis: Discuss both inherent and study-specific uncertainties in the risk assessment process and potential impacts on risk assessment conclusions. (Section 6.0)

The HHRA was performed following standard USEPA guidelines including the following documents:

- *Risk Assessment Guidance for Superfund (RAGS)*, *Volume I, Part A* (USEPA, 1989)
- *RAGS, Volume I, Part D* (USEPA, 1998)
- *RAGS, Volume I, Part E, Dermal Risk Assessment Interim Guidance* (USEPA, 2004)
- *Standard Default Exposure Factors* (USEPA, 1991)
- *Exposure Factors Handbook* (USEPA, 1997a)
- *Calculating Upper Confidence Limits for Exposure point Concentrations at Hazardous*

Waste Sites (USEPA, 2002)
- *Supplemental Guidance to RAGS: Region 1 Risk Updates 1 through 5*

Additional guidance was obtained from Massachusetts Department of Environmental Protection (MADEP) (MCP 1994, 1995, 1996a,b, 1997, 1988, 1999, 2000, 2002a,b,c) to supplement USEPA guidance. A complete list of references for the human health risk evaluation is provided at the end of this chapter. The majority of the tables to be included in this section are analogous to the standard tables required by the recent Risk Assessment Guidance for Superfund: Part D (RAGS Part D) (USEPA, 1998). Data fields to be included in the tables presented in this risk assessment include the majority of data fields specified in the RAGS Part D guidance. The five human health risk assessment components are presented in the following sections.

2.0 HAZARD IDENTIFICATION

The goal of the hazard identification step is to develop a list of chemicals of potential concern (COPCs) for each environmental medium under consideration. Data for the human health risk assessment were obtained from a number of studies. Data were evaluated for data quality, data validation procedures were reviewed for historical data or performed for 2004-2005 data and suitable data were then compiled into a data set to be used for identification of COPCs.

2.1 Data Evaluation

For the Grove Pond site, data evaluation was performed in two stages. As part of the *Data Gap Evaluation Report* (Gannett Fleming, 2002) investigations of the study area and surrounding properties were evaluated for data quality. The majority of the reports were obtained from the BRAC library located at Fort Devens. Other sources of reports included the MADEP Central Regional office and the Town of Ayer public library. Approximately 55 documents were acquired and are maintained in the Gannett Fleming library in Newton, Massachusetts. A listing of these documents with brief descriptions is included in Appendix D of the *Data Gap Evaluation Report* (Gannett Fleming, 2002). The historical data considered for use in this HHRA were obtained from studies deemed useable for risk assessment in the *Data Gap Evaluation Report* (Gannett Fleming, 2002). Subsequent to the development of the *Data Gap Evaluation Report* (Gannett Fleming, 2002), supplemental samples were collected in 2004 and 2005 to address data gaps previously identified. Data used in this human health risk assessment represent a compilation of the historical data identified as suitable for use in the *Data Gap Evaluation Report* (Gannett Fleming, 2002) and the data collected as part of the Expanded Site Investigation (ESI) by Gannett Fleming in 2004 and 2005.

For the historical data, the laboratory analytical data were reviewed for data quality and usability for this risk assessment (DURA). The DURA process, a multi-step process designed by USEPA (1989) and (1992 a,b) involves assessing overall data quality and the usability of data for performing a quantitative risk assessment and selection of COPCs for the human health risk assessment (HHRA) . However, because the majority of the reports used for database input did not include laboratory analytical reports, it was not possible to complete all the formal DURA steps for the HHRA.

Some historical reports lacked analytical reports for each sample. However, the data were deemed usable owing to the original source (usually the US Army Environmental Center) and purpose (data were collected to support Remedial Investigations for this area). Where analytical reports were not available, summary tables found within the reports were used to compile results. In some cases, contaminant concentrations from summary tables represented laboratory method detection limits; however, if there were no notes in the summary tables indicating detection limits, the concentration was entered into the database.

Due to the absence or availability of original laboratory data, the data evaluation process for historical data was truncated to two major steps with the overall objective being to ensure data of sufficient quality to be used to assess potential risks to human health. Simplified, the data evaluation process was performed to two steps:

1) Gather all data available from the site investigation and sort by medium, and

2) Validate and evaluate the data submitted by the laboratory to evaluate acceptability for use in the human health risk assessment. The following section discusses the data validation evaluation.

2.2 Data Validation

The purpose of the validation review that was conducted as part of the *Data Gap Evaluation Report* (Gannett Fleming, 2002) was to evaluate the general quality of each data set and to determine the usability of the data for the HHRA. Many reports were used to assemble the analytical database. These reports were reviewed to determine and evaluate:

1. The level of data validation or review performed at the time the data were generated,
2. The analytical protocols and laboratories utilized, and
3. The availability of Quality Assurance (QA) and Quality Control (QC) information.

The review conducted was similar to an USEPA Region 1 Tier 1 data validation (USEPA, 1996d) review in that one of the goals was to determine whether there was enough information provided to conduct a higher level of data validation, if desired. Review of actual QA/QC data (matrix spike recoveries, etc.) was not performed during this evaluation, nor were any data qualifiers assigned.

The analytical data were generated over a period of 10 to 11 years, by various laboratories, and for many different reasons and entities. The documentation available for each of the data sets is as varied as the sources. It should be noted that none of the data appears to have undergone formal data validation as per USEPA data validation guidelines (USEPA, 1996d). In order to be able to justify combining any of these data sets, minimum usability criteria were implemented to complete this review. Data were determined to be usable for HHRA purposes under the following conditions:

1. USEPA-approved or equivalent laboratory methods were used,
2. Data were generated by an USEPA laboratory or under the Army Corp of Engineers analytical and review protocols,
3. Enough QA/QC information was provided in the report to perform a Tier II level data validation at some future time, or
4. USEPA had already reviewed and accepted the data.

If none of the above conditions were met, the data set was assigned a "Not Acceptable" data usability code for use in the HHRA. As demonstrated in the *Data Gap Evaluation Report* (Gannett Fleming, 2002) the vast majority of the historical data were determined to be usable for characterizing the nature and extent of contamination based on the minimum usability criteria. However, not all data were considered usable in the human health risk assessment for various reasons. For example, the human health risk assessment does not utilize data from samples that were field filtered or collected to support ecological studies. For more detail regarding the quality and usability of the historical data can be found in the *Data Gap Evaluation Report, Appendix G* (Gannett Fleming, 2002).

2.3 Data Compilation

The historical analytical data and the data collected as part of the ESI were subdivided into two study areas to assist in risk management decisions. The study areas are Grove Pond and Plow Shop Pond.

The scope of this project has been limited to pond-related media only. This decision was reached through discussions with the USEPA and as specified in the USEPA Task Request for this project (Contract EP-W-05-020 Task Order #01). While groundwater has been collected at the site, risks associated with this medium will not be included in the HHRA as there is no direct exposure to groundwater in the pond area. The primary purpose of evaluating groundwater in the ESI was to assess the impacts of groundwater discharges to the ponds. Because the surface water and sediment are included in the HHRA for risk quantification, the impacts of groundwater to surface water and sediment are being addressed indirectly. Soil was also not evaluated as part of the HHRA. After considerable discussion, it was decided that soils adjacent to the pond would not be considered as pond-related media.

The media of concern considered in this HHRA include:

- Surface water

- Sediment, and
- Fish tissue

All surface water samples, which passed the data evaluation, were included in this risk assessment. The decision to use all surface water samples was based on the fact that a receptor may potentially contact any point of surface water in the pond from a boat. In addition, surface water mixes over time and therefore, it would be appropriate to develop exposure point concentrations based on all samples collected. However, further consideration was needed regarding the appropriate subset of data to use for sediment and fish tissue.

For sediments, two possible data sets were considered for use: all sediment sampling points and a subset of data sampling points identified as near-shore sediments. It was decided that while sediment samples were collected throughout both ponds, the sediments most likely to be available for exposure on a routine basis are those located within the near shore area. The near-shore sediment area is defined as the area reaching approximately 75 feet into each pond, as shown on Figure 2. If wading were to occur, it is likely, given the mucky consistency of the sediments and the density of the vegetation, that a receptor would not wade farther into the pond than 75 feet from shore. The selection of this area for evaluation does represent an uncertainty and a comparison of analytical results between all sediments and near shore sediments is presented in the uncertainty section of this risk assessment. A comparison of the near shore sediment results to all sediment results is presented in Table 2-1.

Fish tissue results were available for fillet samples and whole body samples. Typically, analytical results from fillet samples are used in a human health risk assessment since humans primarily consume fish fillets rather than whole fish (USEPA 1997a). Although the results for fish fillets were somewhat old (data were from the early 1990s), the differences between fillet results and whole body results were great enough that it would not have been appropriate to combine fillet and whole fish data (see Table 2-2 and Table 2-3). As can be seen in Table 2-2 detection frequencies are similar in Grove Pond fish between fillets (60% detected) and whole body (64% detected) but, as shown in Table 2-3, were lower in fish from Plow Shop Pond fillets (33% detected) compared to whole body results (52% detected). Of possibly greater importance, it appears that concentrations in fillet samples were most commonly four times lower in fillets than in whole body samples (see Figure 3 and Tables 2-2 and 2-3). Thus, the use of whole body samples, given that the fish ingestion habits of humans are relatively well defined and do not include ingestion of whole fish, would likely have resulted in a high bias to the risk results. To avoid this possible inaccuracy, only fish fillet results have been used in this human health risk assessment. The ramifications of the selection of the fillet data only for use in the quantitative risk assessment will be further discussed in the uncertainty section.

Table 2-4 presents a summary of all samples used in the risk assessment for sediment, surface water and fish tissue media in Grove Pond and Plow Shop Pond. The citations for the studies from which historical data were obtained are also presented in this table.

2.4 Selection of Chemicals of Potential Concern

This section presents the selection of Chemicals of Potential Concern (COPC) for all environmental media utilized in the human health risk assessment. The selection of COPC was conducted in accordance with USEPA (1989, 1994) guidance. The process is designed to narrow the focus of the risk assessment to those contaminants that may pose a threat to human health. The criteria used to limit the list of contaminants for future consideration is described below.

Selection Criteria

Several steps were involved in identifying COPCs for further risk analysis.

Risk-Based Screening. Contaminants were screened against risk-based screening concentrations in order to further focus the risk assessment on the compounds that may have a toxic effect on human receptors. Concentrations of chemicals which are below their respective risk-based screening value were not retained for further evaluation in the risk assessment. USEPA Region 9 Preliminary Remediation Goals (PRGs) were used as the human health screening criteria (USEPA Region 9, 2004). The PRGs are screening values that are compiled by using toxicity information to calculate contaminant concentrations that will result in a Hazard Index of 1 or an excess lifetime cancer risk or 1 E-6. If a contaminant has both carcinogenic and non-carcinogenic toxic effects, the lower concentration was selected. In accordance with USEPA Region 1 guidance, PRG values for noncarcinogens were divided by 10 in order to account for the potential additive noncarcinogenic effects. The PRG values available online at the USEPA Region 9 website were used to screen the data in the database. If screening values were not available, the screening value of a similar chemical was used as a surrogate screening value, if appropriate. Values from surrogate chemicals used in the COPC screening process are listed in all RAGS D Table 2s.

Surface water concentrations detected in the study area were screened versus tap water PRG values. Sediment concentrations detected in the study area were screened versus residential soil PRG values. Because USEPA Region 9 has not published PRGs for fish tissue, USEPA Region 3 risk-based concentrations (RBCs) for fish tissue were used (USEPA Region 3, 2005). No comparison to background concentrations was performed.

Frequency of Detection. Chemicals may be deleted from further consideration in the risk assessment if they are infrequently detected (USEPA, 1989) or if the infrequent detection is shown not to be indicative of a "hot spot." Contaminants detected infrequently at high concentrations are typically indicative of a hot spot, or highly localized area of contamination. Hot spot data should be evaluated in the risk assessment and are not eliminated from further consideration. However, contaminants detected infrequently and at low concentrations may be an analytical artifact and should not be carried through the risk assessment. Typically, a detected contaminant in less than 5% of at least 20 samples at a low concentration may be considered for removal from further consideration in the risk assessment, provided that the contaminant is not expected to be present based upon historic activities in the site.

Nutrients. Essential human dietary nutrients were eliminated as COPC. USEPA guidance considers calcium, chloride, iodine, magnesium, phosphorous, potassium and sodium, as essential nutrients. These essential nutrients were not retained for further evaluation in the risk assessment. However, the effect of omitting these chemicals from the quantitative risk analysis is discussed in the uncertainty section of this report.

Lead. In the case of lead, insufficient information exists to develop risk-based screening values. Therefore, the USEPA screening value (USEPA, 1994a) of 400 mg/kg was used to screen soils and sediments. This screening value was selected in accordance with USEPA Region 1 guidance (USEPA, November 1996). No screening was performed for lead found in surface water or fish fillet samples.

Re-inclusion of COPCs. RAGS A discusses the need for a potential reinclusion step during the COPC screening process. Constituents screened may need to be re-included as a COPC for a variety of reasons. For this risk assessment, if one carcinogenic polynuclear aromatic hydrocarbon (PAH) was retained during COPC screening then all carcinogenic PAHs were included as COPCs. Carcinogenic PAHs derive their toxicity from equivalency factors based on the toxicity of benzo(a)pyrene. Therefore, the effects of all carcinogenic PAHs are additive and it is not appropriate to evaluate only a subset of the carcinogenic PAHs present.

The results of the screening process are presented in Tables 2-5 through 2-10. Metals, PAHs, PCBs and DDT/DDD/DDE have been identified as the primary COPCs in surface water, sediment, and fish tissue.

Data Management

In developing a data set for COPC screening, several data management decisions were needed in order to process the data. Field duplicates were screened on the maximum value of a duplicate pair. For development of average concentrations for the data set, the duplicates values were averaged then input as a single result. This procedure prevents over representing a single location.

Elevated nondetected values can result if the sample requires dilution. Sample dilutions may be needed owing to matrix interference or if one constituent is present at a greatly elevated concentration. If a nondetected value exceeded two times the maximum the nondetected value was not used in the data set. This procedure was used to avoid the situation where the maximum value was not an actual detected value but rather a diluting-derived nondetected result.

3.0 EXPOSURE ASSESSMENT

Exposure is defined as the contact of a receptor with a chemical or physical agent (USEPA 1989). An exposure assessment is the determination or estimation (qualitative or quantitative) of the magnitude, frequency, duration, and route of exposure. An exposure assessment is composed of the following steps:

- Characterization of the environmental setting (Section 3.1)
- Summary of the nature and extent of contamination (Section 3.2)
- Identification of potential receptors and exposure pathways (Section 3.3)
- Estimation of exposure concentrations (Section 3.4)
- Estimation of chemical intakes (Section 3.5)

3.1. Characterization of the Environmental Setting

A summary of the specific aspects of the environmental setting, as they relate to the human health risk assessment, is presented below. Characterization of the physical setting includes current land uses and characteristics of site with regard to the human health risk assessment. The purpose of this discussion is to identify media that human receptors may contact while at Grove Pond or Plow Shop Pond and provide a general understanding of the human exposure setting.

Grove Pond

Grove Pond is roughly triangular in shape and covers about 60 acres. The northern shore includes the location of the Plastic Distributing Company (PDC, location of former tannery operations), Pirone Park owned by the Town of Ayer, and residential properties. The southeastern shore is bordered by property owned by the Town of Ayer. The southern shore is also bordered by property owned by Fort Devens. Within this area are Devens' water supply wells, which are currently active with treatment**.** Immediately beyond the Devens' shoreline is the Massachusetts National Guard. The western edge of the pond is formed by the railroad causeway, owned and operated by Guilford Transportation (formerly Boston & Maine Railroad, B&MRR).

Grove Pond is shallow, with maximum water depth approximately 5 to 6 feet, and the water is frequently eutrophic, or well nourished by aquatic plant nutrients. The pond bottom consists largely of a thick mat of decomposing vegetation. Grove Pond receives drainage from Balch Pond, as well as from Cold Spring Brook and Bowers Brook, and discharges through a culvert on the western edge of the pond into Plow Shop Pond. Cold Spring Brook is downgradient of Devens. Bowers Brook connects into Cold Spring.

Recreational features of the pond include a playground, a boat ramp with use restrictions and "Catch and Release" fishing. The area is designated "Catch and Release" for recreational fishing. However, witnesses have observed the local population retaining caught fish, presumably for consumption. Expected recreational activities would include fishing and wading. Dense vegetation typically present on the pond surface would make Grove Pond unattractive for swimming. There are water supply wells and a water treatment plant adjacent to Grove Pond at the southern end.

Plow Shop Pond

Plow Shop Pond is located downstream and to the west of Grove Pond. Surface water flows from Grove Pond to Plow Shop Pond through a culvert. Plow Shop Pond is also a shallow pond and is approximately 30 acres. The central portion of the pond is approximately 8 feet deep, and the deepest portion of the pond is reported to be at the northeast arm of the pond. The water level is controlled by a dam located at the northwest corner of the pond where it forms Nonacoicus Brook and its associated wetlands, which in turn flows approximately 1.5 miles northwest into the Nashua River. Plow Shop Pond is similar to Grove Pond in regards to the aquatic community; however, Plow Shop Pond is smaller and slightly deeper, and the aquatic vegetation tends to be less dense than Grove Pond. (USFW, September 2000)

The northern shore of Plow Shop Pond is bordered by commercial businesses. The eastern shore is the Guilford Transportation railroad causeway. The southern and western shores include the former railroad roundhouse, and woodland and grassland associated with Shepley's Hill Landfill.

Plow Shop Pond is used recreationally for fishing. Dense vegetation typically present on the pond surface would make Plow Shop Pond unattractive for swimming. There are no residences along the pond shore nor are any water supply wells located along Plow Shop Pond. The area is designated "Catch and Release" for recreational fishing. However, witnesses have observed the local population retaining caught fish, presumably for consumption.

3.2 Summary of the Nature and Extent of Contamination

Both the Grove Pond and Plow Shop Pond surface water and sediments were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, PCBs and pesticides. The ESI Report describes in detail the nature and extent of contamination for these classes of compounds therefore, a brief summary is presented here to provide a general perspective of contaminant distribution in these ponds.

Grove Pond

The analytical results for the Grove Pond sediments indicate that the most frequently analyzed and detected class of chemicals included metals, followed by pesticides and PCBs (i.e. primarily DDD, DDE, and DDT). SVOCS and VOCs were the most infrequently detected compounds.

In surface water the most widely and frequently detected class of compounds were metals. The SVOC bis(2-ethylhexyl)phthalate was also detected. This constituent is a common laboratory contaminant. Although this constituent was not flagged as blank qualified during data validation, it is possible that its presence is related to lab-based contamination rather than from a release of hazardous material into surface water. This is likely given the relatively low solubility of bis(2-ethylhexyl)phthalate in water.

Constituents found in fish include metals, PCBs and DDD/DDE.

Plow Shop Pond

The analytical results for the Plow Shop Pond sediments indicate that the most frequently analyzed and detected class of chemicals included metals, followed by polycyclic aromatic hydrocarbons (PAHs). Pesticides, VOCs and PCBs were the most infrequently detected compounds found only at concentrations which did not exceed screening values.

In surface water the most widely and frequently detected class of compounds were metals followed by detections of two VOCs (i.e., likely laboratory artifacts) and one pesticide.

Metals and DDE were the major constituents detected in fillet portion of fish from Plow Shop Pond.

Summary of Conceptual Site Model Development for Arsenic, Cadmium, Chromium, Mercury and Lead

Section 5.0 of the ESI Report presents the fate and transport analysis and conceptual site model for the sources of arsenic, cadmium, chromium, mercury and lead in Grove Pond and Plow Shop Pond sediments. The results of this section are paraphrased below.

- Arsenic levels were found to be elevated in sediments from both Grove Pond and Plow Shop Pond. The source for the arsenic was concluded to be accumulation from groundwater discharge, with elevation in Red Cove sediment probably owing to reduced groundwater from the direction of Shepley's Hill Landfill.
- Cadmium levels were determined to be elevated in sediments but no-pond related source was identified. General anthropogenic input was determined to be the likely source of elevated cadmium in sediments.
- Chromium levels were found to be elevated in sediments from both Grove Pond and Plow Shop Pond. The levels were strongly attributed to waste discharges from the former tannery located on the northwestern shore of Grove Pond.
- Mercury levels were determined to be elevated in sediments from both Grove Pond and Plow Shop Pond. Also, elevated mercury concentrations were correlated with elevated chromium concentrations.
- Lead levels were not found to be elevated in sediments on a pond-wide bases for either pond. However, sediment concentrations of lead were found to be locally elevated in the Tannery Cove in Grove Pond and adjacent to the former railroad roundhouse in Plow Shop Pond.

3.3 Estimation of Exposure Point Concentrations

According to USEPA guidance (December 1989, May 1992, September 1995, December 2002), risk assessments are conducted using a representative Exposure Point Concentration (EPC). For this risk assessment, Exposure Point Concentrations (EPCs) were calculated for COPCs only.

Ideally, the EPC should be the true average concentration within the exposure unit. The true population mean concentrations of the COPCs at a contaminated site are often unknown, and are frequently estimated by the respective sample means based upon the data collected from the site under investigation. In order to address the uncertainties associated with the estimates of the true unknown mean concentrations of the COPCs, appropriate 95% upper confidence limits (UCLs) of the respective unknown means are frequently used in many environmental applications. The computation of an appropriate 95% UCL of practical merit depends upon the data distribution and the skewness associated with the data set under study. The USEPA program ProUCL can be used to compute an appropriate UCL of the unknown population mean using a discernible probability distribution (e.g., normal, lognormal, gamma) and/or a suitable non-parametric distribution-free method.

In December 2002, the USEPA revised the Guidance Document to Calculate the Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (OSWER 9285.670). ProUCL, Version 3.0 consists of all parametric and non-parametric UCL computation methods as described in this revised USEPA UCL Guidance Document.

ProUCL computes parametric UCLs based upon a normal, lognormal, and a gamma distribution. ProUCL also computes UCLs using several nonparametric methods. The computation of an appropriate UCL of the unknown population mean depends upon the data distribution, therefore goodness-of-fit tests need to be performed to assess the data distribution before using one of the UCL computation methods available in ProUCL. Based upon an appropriate data distribution and the associated skewness, ProUCL provides recommendations about one or more 95% UCL computation methods that may be used to estimate the unknown mean concentration of a COPC (USEPA 2004). In the development of 95% UCL values for this project, the recommendations provided by the ProUCL program were used.

In accordance with Region 1 guidance (USEPA Region 1, 1994), the 95% UCLs were compared to the maximum concentration found for each analyte and the smaller of the two was chosen as the EPC and used for the dose calculations. In cases where the data set was small, the maximum concentration was used as the exposure point concentration.

Tables 3-1 through 3-6 present the 95% Upper Confidence Limits (UCLs), the Maximum Concentrations and the EPC selected for each COPC evaluated in each media evaluated.

3.4 Identification of Receptors and Potential Exposure Pathways

An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed individual. A complete exposure pathway generally consists of three elements: (1) a source or chemical release from a source, (2) an exposure point where contact can occur, and (3) (4) an exposure route (i.e., ingestion) at the contact point. If any component is missing, the pathway is deemed incomplete and not quantitatively evaluated in the risk assessment (USEPA, 1989). Elimination of exposure pathways may occur based on professional judgment and evaluation of site-specific conditions, for example if the probability of exposure occurring is low or if the impact of the exposure pathway is expected to minor in comparison to other exposure pathways (USEPA, 1989).

CSM

Figure 4 presents the conceptual site model (CSM) for the project site to assist in the identification of the completed exposure pathways to site-related contamination. The CSM identifies the primary sources of contamination, receiving media, and exposure media, which allows for the identification of potential exposure pathways.

Grove Pond

Based on the information presented earlier, the primary contaminant sources associated with Grove Pond include historical discharge of tannery wastes from a former tannery, and potential effects from a landfill that was formerly located between the tannery and Grove Pond. In addition, north of the tannery were a former foundry and machine shop. East of the former tannery, is Pirone Park, where landfilling may have occurred in the past. Other potential sources of contamination to the pond are: stormwater runoff from the Guilford Transportation railroad yard and causeway on the southern/western shore; historical infilling of portions of the pond's perimeter; inflow from Cold Spring Brook and Balch Pond; and runoff from Fort Devens and the Town of Ayer. Extensive apple orchards lie within the drainage basin for the pond, and historical application of arsenic-containing pesticides has been suggested as a potential contaminant source. The contribution of arsenic and other metals to pond-bottom sediments by discharging groundwater may be significant.

Plow Shop Pond

Plow Shop Pond is bordered to the north by commercial properties. Historical records indicate that a lumber company, northwest of the pond had been in operation since 1887 and at least until 1949. Other potential sources of contamination to the pond are stormwater runoff from the Guilford Transportation railroad and the former Railroad Roundhouse; historical infilling of portions of the pond's perimeter; and Shepley's Hill Landfill.

Identification of Exposure Pathways

The CSM, Figure 4 presents the potential receptors and exposure pathways to be evaluated in this risk assessment. The most likely current and future receptors associated with the two ponds include recreational users and recreational fishermen. Since subsistence fishing may be occurring, a current subsistent fisherman is also evaluated. In addition to fish consumption, the recreational users would be exposed to contaminants in surface water and near-shore sediments while wading or fishing in Grove Pond.

Selection of Exposure Parameters

The exposure parameters selected are intended to determine the Reasonable Maximum Exposure (RME) for each receptor scenario under current site conditions. The RME is the highest exposure that is reasonably expected to occur at a site.

USEPA has established default exposure assumptions for quantifying theoretical exposure doses of site contaminants. When default exposure parameters were not available, parameters were determined based on professional judgment to reflect the specific conditions at the site.

Default exposure assumptions were selected from the following sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.
USEPA, 1994: USEPA, Region 1, Risk Update #2, August 1994.
USEPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995
USEPA, 1997: EPA Exposure Factors Handbook, 1997.
USEPA, 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplement Guidance for Dermal Risk Assessment, Final Guidance.

All exposure parameters for the RME exposure scenarios are presented in Tables 3.7 through 3.14. Site-specific factors which were determined based on professional judgment are discussed below.

Recreational User and Fisherman

It is assumed that the recreational user and fisherman make three visits per week, during the warmer months of May through September (65 visits per year). The recreational user is assumed to spend approximately 4 hours during each visit to Grove Pond.

The child recreational exposure duration is 6 years, from age 1-6. In order to complete the 30 year exposure duration, the adult exposure was assumed to be 24 years.

There is no default sediment ingestion rate; therefore, the default soil ingestion rate of 100 mg/day was selected as the sediment ingestion rate for the adult receptors. A sediment ingestion rate of 200 mg/day was selected for the child receptors.

The only default values available for ingestion of surface water while wading are presented by USEPA Region 4. Therefore, the surface water ingestion rate of 0.01 l/hour as presented by USEPA Region 4 was selected for the recreational adult receptor. The surface water ingestion rate of 0.05 l/hour as presented by USEPA Region 4 was selected for the recreational child receptor.

Recreational and Subsistence Fisherman

It is assumed that all of fish consumption for both groups of fisherman is from fish caught in Grove Pond or Plow Shop Pond. Therefore, the fraction ingestion is assumed to be 1.

3.5 Estimation of Exposure Doses and Intakes

The next step in the estimation of exposure is to determine the chemical-specific exposures for each pathway identified to be a complete exposure pathway. Exposure estimates are expressed in terms of the mass of the substance in contact with the body per unit body weight per unit time, typically mg of substance/kg of body weight per day. These exposures are termed "intakes" and are equivalent to administered or applied doses. These calculated intakes are expressed as the amount of chemical at the exchange boundary (i.e., skin, lungs, gut) and available for absorption. The administered or applied dose is not equivalent to the amount of substance actually absorbed into the bloodstream. In the case of dermal exposure, intakes are multiplied by an absorption factor to determine the amount of the substance actually absorbed into the blood stream.

Calculation of intake factors or the daily dose for each chemical and receptor was performed for the appropriate exposure pathway (e.g. inhalation, ingestion, dermal). The equations are presented in Tables 3-7 through 3-14.

Dermal exposure requires the determination of absorbed doses rather than applied doses. For sediments or soils, literature-based chemical-specific dermal absorption factors are used in the development of the absorbed dose. The dermal absorption fraction values or ABS_d are presented in Table 3-15.

For exposure to surface water, the development of absorbed doses is more complex. First the amount of chemical absorbed per body area per day must be determined. This value is called the DA_{event} . Table 3-16 presents the derivation of DA_{event} values for each COPC found in Grove Pond or Plow Shop Pond surface water. DA_{event} values are combined with other intake values to obtain the daily absorbed dose (as shown in RAGS D Table 4s).

4.0 TOXICITY ASSESSMENT

The purpose of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood of adverse effects (USEPA, 1989). The toxicity assessment is composed of two parts:

- Hazard Identification - Hazard identification is the process of determining whether the exposure to a contaminant can cause an increase in the incidence of a particular adverse health effect. Hazard identification also involves characterizing the nature and strength of the evidence that adverse effects may occur as a result of exposure to an agent.

- Dose Response Evaluation - Does response evaluation is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant received and the incidence of adverse health effects in the receptors. From this quantitative dose-response relationship, toxicity values can be derived to estimate the potential for adverse effects in receptors that may have been exposed to different concentrations of the specific agent.

Exposure to carcinogenic and non-carcinogenic toxic contaminants is responsible, by definition, for creating different toxic endpoints or effects. There are also differences in the biological processes through which carcinogenic and non-carcinogenic contaminants can cause adverse effects to a receptor. Therefore, the evaluation of carcinogenic and non-carcinogenic health effects are evaluated separately in human health risk assessments. The methods used to derive toxicity values for carcinogens and non-carcinogens are discussed below.

The toxicity factors (i.e., RfDs and CSFs) used in this risk assessment reflect the most current toxicological information available from the following hierarchy of sources (USEPA, 2003a):

1. Integrated Risk Information System (IRIS) (USEPA, 2004a).
2. Provisional Peer-Reviewed Toxicity Values (PPRTVs) (USEPA, 2004c).
3. Other sources, including but not limited to:
   - National Center for Environmental Assessment (NCEA), presented in Region III's RBC Table (USEPA Region 3, 2005).
   - Office of Environmental Health Hazard Assessment (OEHHA) (Cal/EPA, 2004).
   - Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b).
   - Values withdrawn from IRIS or HEAST (presented in Region III's RBC Table (USEPA, 2004e).
   - Agency for Toxic Substances and Disease Registry (ATSDR), minimal risk levels (MRLs)(2004).

Noncarcinogenic toxicity values used in the risk assessment are provided in Table 4-1. Information regarding target organ effects is also presented in these tables. Carcinogenic toxicity values and weight of evidence information are presented in Table 4-2.

Quantitative risk assessment cannot be performed for chemicals without chronic toxicity values. COPCs without toxicity values were evaluated qualitatively in the Uncertainty Discussion, Section 5.4 of this risk assessment. In some cases, toxicity information from a chemically and toxicologically similar may be used as a surrogate. Cases in which surrogate toxicity values are clearly indicated in the toxicity tables.

4.1 Noncarcinogenic Dose Response

A number of chemicals have been determined to have toxic effects other than carcinogenesis, such as respiratory illness, skin irritation, etc. In addition, chemicals may also be carcinogenic in addition to other toxic endpoints. The evaluation of noncancer effects (USEPA 1989) involves:

- Qualitative identification of the adverse effect(s) associated with the chemical; these may differ depending on the duration (acute or chronic) or route (oral or inhalation) of exposure
- Identification of the critical effect for each duration of exposure (i.e., the first adverse effect that occurs as dose is increased)
- Estimation of the threshold dose for the critical effect for each duration of exposure
- Development of an uncertainty factor, i.e., quantification of the uncertainty associated with interspecies extrapolation, intraspecies variation in sensitivity, severity of the critical effect, slope of the dose-response curve, and deficiencies in the database, in regard to developing an RfD for human exposure
- Identification of the target organ for the critical effect for each route of exposure

The potential for noncarcinogenic health effects resulting from exposure to chemicals is assessed by comparing an exposure estimate (intake or dose) to a Reference Dose (RfD). RfDs are estimates (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfD is expressed in units of mg/kg-day, and represents a daily intake of a contaminant per kilogram of body weight that is not sufficient to cause the threshold effect of concern. An RfD is specific to the chemical, the route of exposure, and the duration over which the exposure occurs. Separate RfDs are represented for ingestion, dermal, and inhalation pathways.

RfDs are expressed as the administered dose. However, exposure estimates for the dermal pathway are expressed as an absorbed dose. Therefore, it is usually necessary to adjust oral toxicity values from administered to absorbed doses in order to evaluate the dermal exposure pathway. Dermal RfDs are derived from the corresponding oral values, provided there is no evidence to suggest that dermal exposure induces exposure route-specific effects that are not appropriately modeled by oral exposure data. Oral toxicity values are adjusted to account for oral absorption efficiencies of the specific chemical. Oral absorption efficiency values are referred to as Gastrointestinal Absorption Factors (ABS_{GI}). Chemical-specific GAF values may be available from toxicological resources, such as ATSDR Toxicological Profiles, and should be used when available.

In the derivation of a dermal RfD, the oral RfD is multiplied by the gastrointestinal absorption factor (ABS_{GI}), expressed as a decimal fraction. The resulting dermal RfD, therefore, is based on absorbed dose. The RfD based on absorbed dose is the appropriate value with which to compare a dermal dose, because dermal doses are expressed as absorbed rather than exposure dose.

RfD values are derived for both chronic and subchronic exposure. Under the assumption of monotoxicity (incidence, intensity, or severity of effects can increase but can not decrease, with increasing magnitude or duration of exposure), a chronic RfD may be considered sufficiently protective for subchronic exposure, but a subchronic RfD may not be protective for chronic exposure. Given the exposure durations involved in the scenarios at the site, chronic RfDs were used for the purposes of this risk assessment. Noncancer toxicity values are provided in Tables 4-1

Target Organ Toxicity

As a matter of science policy, USEPA assumes dose-and effect- additivity for noncarcinogenic effects (USEPA, 1989). This assumption provides the justification for adding the hazard quotients (HQ) or HIs in the risk characterization for noncancer effects resulting from exposure to multiple chemicals, pathways or media. USEPA (1989), however, acknowledges that adding all HQ and HI values may overestimate hazard, because the assumption of additivity is probably appropriate only for those chemicals that exert their toxicity by the same mechanism.

Mechanism of toxicity data sufficient for predicting additivity with a high level of confidence are available for very few chemicals. In the absence of such data, USEPA (1989) assumes that chemicals that act on the same target organ may do so by the same mechanism of toxicity, e.g., target organ serves as a surrogate for mechanism of toxicity. When the total HI for all media for a receptor exceeds 1 due to the contributions of several chemicals, it is appropriate to segregate the chemicals by route of exposure and mechanism of toxicity (i.e., target organ) and estimate separate HI values for each. Segregated target organ Hazard Indices for COPCs are provided in Appendix C, Tables C-29 through C-36 of this report.

As a practical matter, since human environmental exposures are likely to involve near-or sub-threshold doses, the target organ chosen for a given chemical is the one associated with the critical effect. If more than one organ is affected at the threshold, the more severely affected organ is chosen. The target organ is also selected on the basis of duration of exposure (i.e., the target organ for chronic or subchronic exposure to low or moderate doses is selected rather than the target organ for acute exposure to high doses) and route of exposure. Because dermal RfD values are derived from oral RfD values, the oral target organ is adopted as the dermal target organ. For some chemicals, no target organ is identified. This occurs when no adverse effects are observed or when adverse effects such as reduced longevity or growth rate are not accompanied by recognized organ- or system-specific functional or morphologic alteration.

4.2 Carcinogenic Dose-Response

A number of chemicals are known, and many more are suspected, to be human carcinogens. The evaluation of potential carcinogenicity of a chemical includes both a qualitative and a quantitative aspect (USEPA 1989). The qualitative aspect is a weight-of-evidence evaluation of the likelihood that a chemical might induce cancer in humans. The EPA weight-of-evidence classification is a system for characterizing the extent to which the available data indicate that an agent is a human carcinogen (USEPA, 1989). USEPA (1989) currently recognizes six weight-of-evidence classifications for carcinogenicity.

- Group A - Human Carcinogen. Human data are sufficient to identify the chemical as a human carcinogen.

- Group B1 - Probable Human Carcinogen. Human data indicate that a causal association is credible, but alternative explanations can not be dismissed.

- Group B2 - Probable Human Carcinogen. Human data are insufficient to support a causal association, but testing in animals support a causal association.

- Group C - Possible Human Carcinogen. Human data are inadequate or lacking, but animal data suggest a causal association, although the studies have deficiencies that limit interpretation.

- Group D - Not Classifiable as to Human Carcinogenicity. Human and animal data are lacking or inadequate.

- Group E - Evidence of Noncarcinogenicity to Humans. Human data are negative or lacking, and adequate animal data indicate no association with cancer.

USEPA (1989) assumes that a small number of molecular events can create changes in a single cell that can lead to uncontrolled cellular proliferation and eventually to clinical cancer. This hypothesized mechanism for carcinogenesis is referred to "nonthreshold," because there is believed to be essentially no threshold below which harmful effects may possibly occur as a result of exposure.

The toxicity value for carcinogenicity, called a cancer slope factor (CSF), is an estimate of carcinogen potency. Potency estimates are developed only for chemicals in Groups A, B1, B2, and C (known or suspected carcinogens), and only if data are sufficient. The potency estimates are statistically derived from the dose-response curve from the best human or animal studies of the chemical. The CSFs should always be accompanied by the weight-of-evidence classification to indicate the strength of the evidence that the agent is a human carcinogen (USEPA, 1989). The CSF is usually described as the "excess risk" per unit dose above the rate that might normally be expected in the general population.

The CSF is expressed as risk per mg/kg-day. To be appropriately conservative, the CSF is usually the 95 percent upper-bound on the slope of the dose-response curve extrapolated from high (experimental) doses to the low-dose range expected in environmental exposure scenarios.

The oral CSF is usually derived directly from the experimental dose data, because oral dose is usually expressed as mg/kg-day. When the test chemical is administered in the diet or drinking water, oral dose first must be estimated from the test chemical in the food or water, food or water intake data, and body weight data.

CSFs are expressed as the administered dose. However, exposure estimates for the dermal pathway are expressed as an absorbed dose. Therefore, it is usually necessary to adjust oral toxicity values from administered to absorbed doses in order to evaluate the dermal exposure pathway. Dermal CSFs are derived from the corresponding oral values, provided there is no evidence to suggest that dermal exposure induces exposure route-specific effects that are not appropriately modeled by oral exposure data. Oral toxicity values are adjusted to account for oral absorption efficiencies of the specific chemical. Oral absorption efficiency values are referred to as Gastrointestinal Absorption Factors (ABS_{GI}). Chemical-specific ABS_{GI} values may be available from toxicological resources, such as ATSDR Toxicological Profiles, and should be used when available.

The dermal CSF is derived by dividing the oral CSF by the ABS_{GI}. The oral CSF is divided, rather than multiplied, by the ABS_{GI} because CSFs are expressed as reciprocal dose. The USEPA weight-of-evidence group and the oral, dermal and inhalation CSFs for COPC are presented in Table 4-2.

4.3 Compound-Specific Dose - Response

Carcinogenic PAHs.

The toxicity assessment for carcinogenic PAHs (cPAHs) may be performed with a Toxic Equivalence Factor (TEF) methodology. The toxicity of carcinogenic PAHs is based on a relative potency of each compound to that of benzo(a)pyrene. Cancer slope factors adjusted using TEFs are presented in Table 4-2. As discussed above, all carcinogenic PAHs were retained as COPCs in any medium where at least one carcinogenic PAH exceeded its screening value.

5.0 RISK CHARACTERIZATION

Risk characterization is the combination of the results of the exposure assessment and toxicity assessment to yield a quantitative expression of risk for the exposed receptors. This quantitative expression is the probability of developing cancer, or a nonprobabilistic comparison of estimated dose with a reference dose for noncancer effects. Quantitative estimates are developed for individual chemicals, exposure pathways, and exposure media for each receptor. The risk characterizations presented in this risk assessment are based on the Reasonable Maximum Exposure (RME) scenario and are generally used to guide risk management decisions.

This section presents estimates of risk for the relevant pathways and receptors for each scenario as described in previous sections. All chemicals of concern were evaluated by the determination of non-cancer Hazard Quotients (HQ) and Cancer Risks. Section 5.1 presents the methodology used to calculated noncancer hazards and cancer risks. Section 5.2 discusses cumulative non-cancer health risks and cumulative cancer risks. Section 5.3 discusses the evaluation procedures used in the evaluation of lead.

Generally, risk characterization follows the methodology prescribed by USEPA (1989a), as modified by more recent information and guidance. The USEPA methods are, appropriately, designed to be health-protective, and tend to overestimate, rather than underestimate, risk. The risk results are generally overly conservative, because risk characterization involves multiplication of the conservatism built into the estimation of source-term and exposure-point concentrations, the exposure (intake) estimates, and the toxicity dose-response assessments.

Although some chemicals induce both cancer and noncancer effects, the risks for each endpoint are calculated separately.

5.1 Cancer Risks

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen.

Cancer Risk Calculation Equation:

$$\mathbf{ILCR_i = CDI_i * CSF_i}$$

Where:

$ILCR_i$ = Incremental Lifetime Cancer Risk for chemical "i," expressed as a unitless probability

CDI_i = Calculated Average Daily Intake of chemical "i" expressed as an average daily dose in (mg/kg-day)

CSF_i = Inhalation cancer slope factor for chemical "i" in $(mg/kg\text{-}day)^{-1}$

Individual chemical-specific cancer risks are summed to estimate the total incremental individual lifetime cancer risk for simultaneous exposure to several carcinogens. The risk summation technique does not presume any synergistic or antagonistic chemical interactions. This assumption may result in either an underestimation or overestimation of the actual risk that may result from actual exposure to multiple substances.

The cancer risk calculations for all receptors are presented in Appendix C in Tables C-1 through C-24. Tables C-1 though C-24 illustrate the development of the intake values and hazard quotients by each medium. Tables C-25 through C-28 present a RAGS D Table 9-style summary of cancer risks for the recreational adult and child receptors for Grove Pond and Plow Shop Pond. These receptors were evaluated for cancer risks from exposure to multiple media including sediments, surface water and fish tissue.

5.2 Non-cancer Risks

The Hazard Quotient (HQ) is the potential for noncarcinogenic effects as a result of exposure. The HQ is a ratio of exposure over a specified period of time to a reference dose derived for a similar period of time. As a rule, the greater the value of the HQ above unity (HQ>1), the greater the level of concern.

Estimating risk or hazard by considering only one chemical at a time might significantly underestimate the risks associated with simultaneous exposures to several COPCs. To assess the potential for noncarcinogenic effects posed by more than one COPC, a Hazard Index (HI) is then calculated. The HI is equal to the sum of the hazard quotients.

The following risk equations were used to calculate hazard quotient (HQ):

Hazard Quotient Calculation Equation:

$$HQ_i = \frac{CDI_i}{RfD_i}$$

Where:

HQ_i = Hazard Quotient for chemical "i" (unitless)

CDI_i = Calculated Average Daily Intake of chemical "i" expressed as an average daily dose in (mg/kg-day)

RfD_i = Reference Dose of chemical "i" in (mg/kg-day)

The hazard index (HI) describes the overall potential for noncarcinogenic effects posed by more than one chemical. The approach assumes that simultaneous exposures to several chemicals could produce an adverse effect. The HI is generated by summing the individual HQs for all the COPCs. The magnitude of the adverse effect is assumed to be proportional to the sum of the ratios of the sub-threshold exposures to acceptable exposures. As with the individual hazard quotients, there is a potential for adverse health effects when the HI exceeds one (1).

Hazard Indices were segregated by target organ and associated critical effect. This approach more appropriately results in identification of endpoints that reflect adverse effects on the same organ system by the same mechanism. Segregation of HI requires identification of the major effect(s) of each COPC. The target organ effect was selected based on the target organ corresponding to the oral RfD listed in IRIS and HEAST or information in ATSDR profiles. In cases where a COPC affects more than one target organ, the HI was used to calculate the target organ effect for each target organ it affects.

The noncancer risk calculations for all receptors are presented in Appendix C. Tables C-1 though C-24 illustrate the development of the intake values and hazard quotients by each medium. Tables C-25 through C-28 present a RAGS D Table 9-style summary of HIs for the recreational adult and child receptors for Grove Pond and Plow Shop Pond. These receptors were evaluated for noncancer hazards from exposure to multiple media including sediments, surface water and fish tissue.

5.3 Lead

Because of its unique toxicological properties, lead requires an alternate evaluation than that performed for non-carcinogenic or carcinogenic chemicals. The output and summary results for the lead evaluation are presented in Appendix D. Output includes RAGS D adult lead worksheets, Adult lead model print outs, RAGS D IEUBK lead model worksheets, IEUBK lead model tabular output and IEUBK probability density function graphs for blood lead.

<u>Adult Recreational Receptor</u>

For the recreational adult receptor, risks from exposure to lead were calculated using the USEPA Adult Lead Model, dated 5/19/03 (USEPA 1996). This approach determines the 95th percentile blood lead concentration among fetuses born to women having exposures to the soil concentration present at the Site. The calculated value is then compared with the threshold blood level for lead of 10 ug/dL which the USEPA has established as being associated with no adverse effects in children. Site-specific EPCs for lead, representing the arithmetic average, for sediment were used in the evaluations of Grove Pond and Plow Shop Pond sediment. Threats from surface water and fish ingestion could not be evaluated for this receptor because currently the model is designed only to consider soils/sediment. The geometric standard deviation for a heterogeneous population was selected as a conservative assumption. Site-specific values for both the exposure frequency of 65 days/year and the averaging time of 152 days a year were used. Model literature on evaluating intermittent exposure to lead indicates that exposures should not be annualized and that models are suitable for use when exposure exceeds three months (see USEPA 2004d). Therefore, exposure for the five month exposure periods of May to September was used as the averaging time. A site-specific sediment ingestion rate of 100 mg/day as shown in the RAGS D Table 4s was used in this modeling as well.

Child Recreational Receptor

An RfD is not available with which to evaluate the toxicity of oral exposure to lead. It is generally agreed that the young child is the most sensitive receptor for exposure to lead. Therefore, evaluating the child recreational receptor exposed to the levels of lead found in the media of interest at the Site provides a worst-case snapshot of the impact of lead. The USEPA (1994b) Integrated Exposure Uptake Biokinetic Model (IEUBK) integrates exposure to lead from various sources to estimate mean blood lead concentrations for the first 7 years of a child's life, and predicts the statistical variation about the mean. The IEUBK model is used to evaluate lead in the various media at the Site. For the recreational child receptor, risks from exposure to lead were calculated using the Integrated Exposure Uptake Biokinetic (IEUBK) Model, version 1.0 build 261.

Exposure input values included arithmetic mean lead concentrations from sediment in Grove Pond and Plow Shop Pond, default drinking water values since arithmetic mean surface water values from both Ponds were less than the default drinking water value and arithmetic mean fish tissue values for fish from Grove Pond. Lead in fish was not a COPC for Plow Shop Pond. Model defaults were used for soil bioavailability and ingestion rate. Because the exposure being evaluated was anticipated to occur regularly over a five or nine month period, no time-adjusted input was needed as discussed in the USEPA guidance in intermittent exposure to lead (see USEPA 2004d). Fish tissue was included by assuming that 41 out of 273 meat meals or 15% of meat meals consisted of Grove Pond Fish. This value was derived from assuming that the recreational child consumed one meal of Grove Pond caught fish per week for nine months of the year (39 weeks).

Child Subsistence Angler Receptor

For the subsistence child angler receptor in Grove Pond, risks from exposure to lead were also calculated using the Integrated Exposure Uptake Biokinetic (IEUBK) Model, version 1.0 build 261. Input parameter values for this receptor were identical to those of the child recreational receptor with one exception. Fish tissue was included by assuming that 273 out of 273 meat meals or 100% of meat meals consisted of Grove Pond Fish. This value was derived from assuming that the recreational child consumed seven meals of Grove Pond caught fish per week for nine months of the year (39 weeks). Because the exposure being evaluated was anticipated to occur regularly over a five or nine month period, no time-adjusted input was needed as discussed the USEPA guidance in intermittent exposure to lead (see USEPA 2004d).

5.4 Qualitative Risk Results

Cumulative Cancer Risks

In order to assess the potential risks the estimated chronic intakes for each pathway are multiplied by the cancer slope factor or the unit risk (used in some inhalation pathways). These results are presented for each pathway in the column entitled Risk in the Tables included in Appendix C. Risks calculated for each chemical are summed to a cumulative risk in each table. RAGS D Table 10s which highlight individual chemical risk drivers are also presented in Appendix C. Cumulative risk summaries by receptor are presented in Table 5-1 for Grove Pond media and Table 5-2 for Plow Shop Pond media.

Grove Pond (see Table 5-1). Cumulative risks from exposure to fish tissue resulted in risks greater than the USEPA specified risk threshold range of 1E-4 to 1E-6 for the adult subsistence angler. Risks equaled 2E-4. The risk drivers (chemicals with risks greater than 1E-6) included PCBs, DDD and DDE. Risks for all other receptors were within the USEPA-specified risk range. However, risks to both the recreational adult and the recreational child equaled the upper end of this range (1E-4). Risk drivers included arsenic and PAHs in sediment, arsenic and bis(2-ethylhexyl)phthalate in surface water and PCBs in fish. Cumulative risks to the child subsistence angler equaled 7E-5.

Plow Shop Pond (see Table 5-2). Cumulative risks from exposure to sediment, surface water and fish resulted in risks greater than the USEPA specified risk threshold range of 1E-4 to 1E-6 for the recreational adult (4E-4) and recreational child receptors (4E-4). The risk drivers included arsenic and PAHs in sediments and arsenic in surface water and fish. Cumulative risks from exposure to fish tissue resulted in risks greater than the USEPA specified risk threshold range of 1E-4 to 1E-6 for the adult subsistence angler. Risks equaled 5E-4. The risk drivers (chemicals with risks greater than 1E-6) included arsenic and DDE. Risks the child subsistence angler equaled the upper end of this range (1E-4). Risk drivers included arsenic and DDE in fish.

Cumulative Non-Cancer Health Risks

In order to assess the potential adverse health effects associated with chronic exposures to site receptors, the estimated chronic intakes for each pathway are compared to the acceptable concentration for each constituent, which is the RfD. These comparisons are ratios of the estimated daily exposure to the RfD and are presented for each pathway in the column entitled Hazard Quotient (HQ) in Appendix C. Hazard Quotients calculated for each chemical are summed to a Hazard Index (HI) in each table.

In the summing of individual HQs, assumptions are made including: the chemicals act in an additive fashion rather than synergistically or antagonistically; the chemicals act on similar organ systems and with similar modes of action. The veracity of these assumptions will impact the accuracy of the hazard estimate developed in this risk characterization.

Grove Pond (see Table 5-1). As shown in Table 5-1, for all receptors evaluated, noncancer hazards exceeded the USEPA-specified risk threshold of one (1). Risk drivers, meaning chemicals with individual HQs in excess of one, for at least one receptor, included arsenic in sediment and mercury and PCBs in fish.

Plow Shop Pond (see Table 5-2). As shown in Table 5-2, for all receptors evaluated, noncancer hazards exceeded the USEPA-specified risk threshold of one (1). Risk drivers, meaning chemicals with individual HQs in excess of one, for at least one receptor included arsenic and chromium in sediment, arsenic in surface water and mercury and vanadium in fish.

Lead

Results of the lead evaluations are presented in Appendix D and summarized in Tables 5-1 for Grove Ponds and 5-2 for Plow Shop Pond. The blood lead threshold has been established by USEPA as a probability value of no greater than a 5% chance of blood lead exceeding 10 ug/dL for the fetus, as evaluated with the adult lead model, or for the child, as evaluated with the IEUBK model. For Grove Pond, only the child subsistence angler was found to have risks in excess of this threshold. In Plow Shop Pond lead was not a COPC in fish. Neither the adult or child recreational receptors had lead risks that exceeded the associated threshold values.

6.0 UNCERTAINTY ANALYSIS

6.1 Inherent Sources of Uncertainty

Since the assumptions and other aspects of risk assessments are intended to be conservative, some degree of uncertainty is inherent to the process. Inherent sources of uncertainty typically relate to four areas:

1.) the data evaluation process
2.) the exposure assessment;
3.) the toxicity assessment;

4.) the risk characterization.

Inherent sources of uncertainty relating to the data evaluation process include:

- Field Sampling location bias: sample locations were biased toward areas of highest contamination
- Use of one-half the detection limit for all non-detected values when calculating 95% UCLs of the mean
- Lack of consideration of source depletion, natural degradation or attenuation of COPCs over time
- Limitations on the determination of background conditions

Inherent sources of uncertainty relating to the exposure assessment include:

- Assumption that exposure scenarios and contact with affected media will occur
- Selection of the 95% UCL of the mean or the maximum concentration for the exposure point concentration
- Assumption of frequent, routine exposure over prolonged durations
- Use of default exposure values for physiological parameters such as skin surface area, inhalation rate and soil ingestion rates
- Assumption that some pathways are negligible in comparison to others

Inherent sources of uncertainty relating to the toxicity analysis include:

- Use of published RfDs and SFs derived by standard USEPA methods
- Derivation of dermal SFs and RfDs using ABS_{GI} values
- Derivation of toxicity values for cPAHs based on TEFs
- Lack of toxicity values for some chemicals or exposure routes
- Assumption of 100% bioavailability of COPCs from sediment
- Assessment of mercury, which was measured analytically as total mercury, using the oral RfD for mercuric chloride rather than the oral RfD for methylmercury

Inherent sources of uncertainty relating to the risk characterization include:

- Assumption of additivity of toxicological effects
- Risk characterization does not consider antagonistic or synergistic effects. Little information is available to determine the potential for antagonism or synergism for the COPCs. Therefore, this uncertainty cannot be discussed for its impact on the risk assessment, since it may either underestimate or overestimate potential human health risk.

6.2 Site-Specific Sources of Uncertainty

In addition to the uncertainties inherent in the risk assessment process, there are typically uncertainties associated with site-specific information, contaminants or conditions. The following site-specific sources of uncertainty apply to this site:

Data Set Used

These risk results were based upon a data set derived from multiple studies conducted over a 13 year period. Older data may not be indicative of current conditions. However, it is assumed that the direction of bias with this uncertainty would be conservative in that it is not anticipated that conditions in the Ponds would have become more contaminated over time.

Sediment COPC Selection

Since screening values are not available for sediment, residential soil screening values were used in the selection of COPCs for sediment. This is considered a conservative approach which may actually overestimate potential risks.

Surface Water COPC Selection

Since screening values are not available for surface water, tap water screening values were used in the selection of COPCs for surface water. This is considered a conservative approach which may actually overestimate potential risks.

Uncertainties related to Iron and Copper

Risk screening indicated that copper and iron exceeded the EPA Region 9 PRG for residential soil in both ponds. Iron, but not copper, in surface water exceeded the Region 9 PRGs for residential drinking water in both ponds. The toxicity values for iron and copper were derived based on concentrations needed to protect against a deficiency of the compound, rather than on quantitative assessments related to the hazard posed by overexposure to these metals. In fact, USEPA Region I does not advocate quantitatively evaluating exposures and risks of these metals owing to the uncertainty of these toxicity values (USEPA, 1999). Because of the uncertainty of the toxicity information for iron and copper, any risks from exposure to these metals should be considered suspect and greatly overestimated. The uncertainties related to the toxicity values for iron and copper indicate that the potential risks may be greatly overestimated. Therefore, further actions based on concentrations of iron or copper in sediment and surface water seem unwarranted.

Uncertainties related to Background

Many metals occur naturally. Metals in this HHRA were not eliminated as COPCs based on background conditions. As such, risk values reported in this risk assessment include some contribution from background related metals. Since determination of statistically bounded background concentrations is beyond the scope of this investigation, it is not possible to quantify the contribution of background metals to the risk results obtained.

7.0 SUMMARY AND CONCLUSIONS

7.1 Summary of Risk Characterization

Tables 5-1 and 5-2 and Appendix C, Tables C-29 through C-36 present summaries of the cancer risks and noncancer hazard indices which exceeded EPA acceptance criteria for each receptor evaluated in the risk assessment. These tables identify the chemicals which are driving the risks and present the hazard indices segregated by target organ. Section 6.0 presented the uncertainties associated with the risk evaluations and presented rationale for consideration in determining the chemicals of concern for this site which may require further evaluation and action.

7.2 Conclusions

Grove Pond

The human health risk assessment evaluated risks to four receptors: a recreational adult, recreational child, subsistence angler adult and subsistence angler child. Media considered in the recreational receptor evaluations included sediment, surface water and fish tissue. The only medium used in the evaluation of risks to the subsistence angler receptors was fish tissue. For Grove Pond, the carcinogenic risk threshold of 1E-4 was equaled for the recreational adult and recreational child. This threshold was exceeded for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers, defined as chemicals with risks in excess of 1E-6, for the recreationa receptors included arsenic (surface water and sediment), PAHs (sediment), phthalates (surfacewater) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment), mercury (fish tissue), and PCBs (fish tissue).

Carcinogenic risk drivers for the subsistence angler included PCBs, DDD and DDE. Noncarcinogenic risk drivers included mercury and PCBs.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children but were exceeded for the subsistence angler child receptor.

Plow Shop Pond

Human health risk assessment results for Plow Shop Pond were similar to those from Grove Pond. For Plow Shop Pond, the carcinogenic risk threshold of 1E-4 was exceeded for the recreational adult and recreational child. This threshold was equaled for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers for the recreational receptors included arsenic (surface water, sediment and fish tissue), PAHs (sediment) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment, surface water), chromium (sediment), and mercury (fish tissue).

Carcinogenic risk drivers for the subsistence angler included arsenic and DDD. Noncarcinogenic
risk drivers included mercury and vanadium.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children. Lead was not a chemical of potential concern in fish tissue from Plow Shop Pond.

Evaluation of Results

This section compares human health risk results to the findings of the fate and transport/environmental chemistry evaluation performed for this study. Of this risk drivers
identified in the human health risk assessment, the metals arsenic, chromium, mercury and lead
appear to be related to identifiable sources within Grove and Plow Shop Ponds including area-wide groundwater for arsenic. Vanadium has not been identified as a metal with clear Pond-related sources. It is possible that elevated levels of this metal and associated risks occur as a result of mobilization of naturally occurring metals by reduced groundwater that enters the ponds from the direction of Shepley's Hill Landfill or other areas.

Organic constituents identified as risk drivers include PAHs, PCBs and DDT breakdown products. While these chemicals are clearly anthropogenically-related, multiple sources for these chemicals appear applicable. Sources may have included upstream contamination, stormwater runoff, atmospheric deposition as well as contributions from the former tannery and railroad roundhouse located on the shores of these ponds. Currently, it is not possible to clearly attribute the contribution levels of these sources to the concentrations observed. However, it does not appear that groundwater is a contributor of organic constituents to the Ponds.

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FIGURES

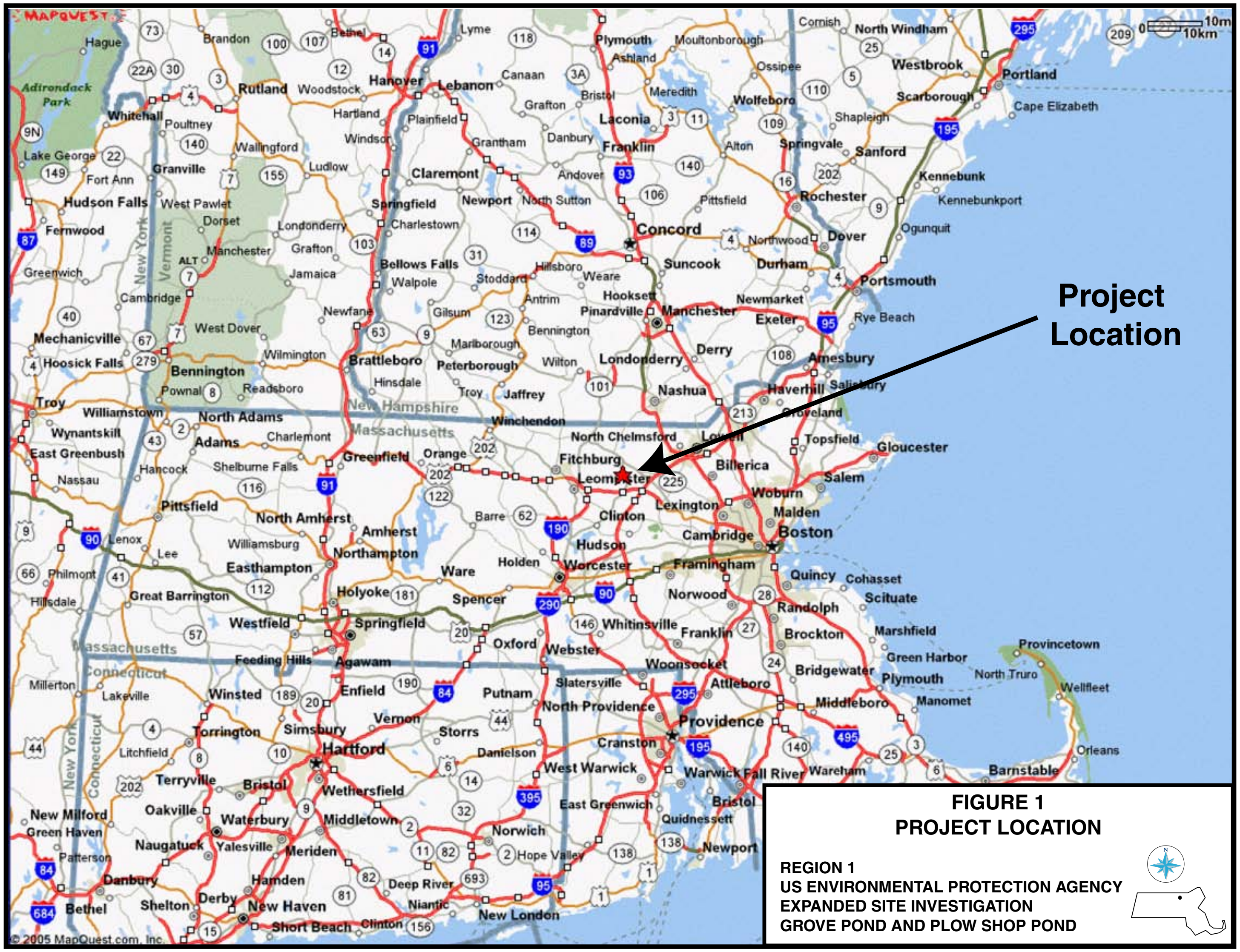

FIGURE 1
PROJECT LOCATION

REGION 1
US ENVIRONMENTAL PROTECTION AGENCY
EXPANDED SITE INVESTIGATION
GROVE POND AND PLOW SHOP POND

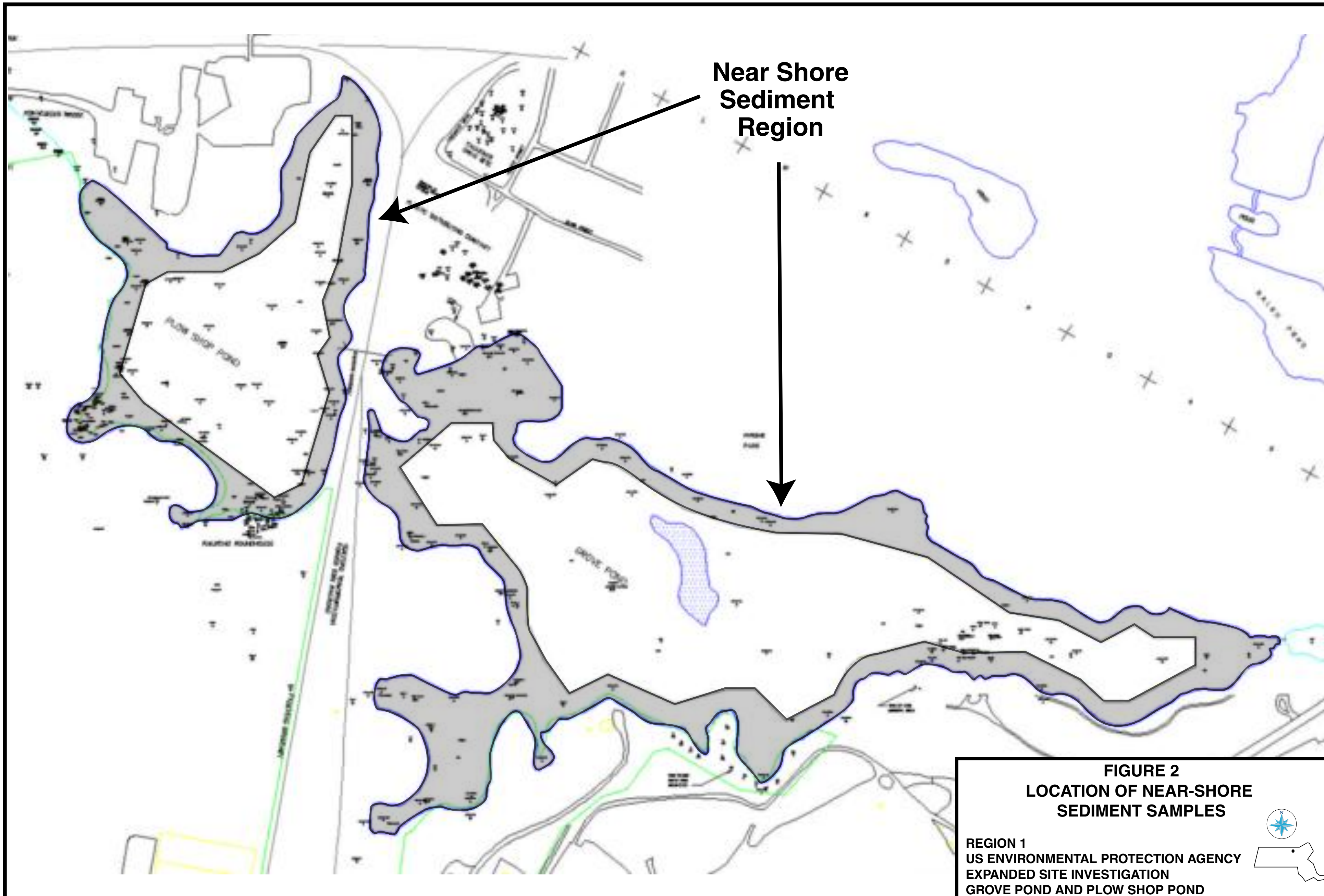

FIGURE 2
LOCATION OF NEAR-SHORE SEDIMENT SAMPLES

REGION 1
US ENVIRONMENTAL PROTECTION AGENCY
EXPANDED SITE INVESTIGATION
GROVE POND AND PLOW SHOP POND

FIGURE 3
COMPARISON OF FILLET TO WHOLE FISH TISSUE RESULTS
GROVE POND/PLOW SHOP POND

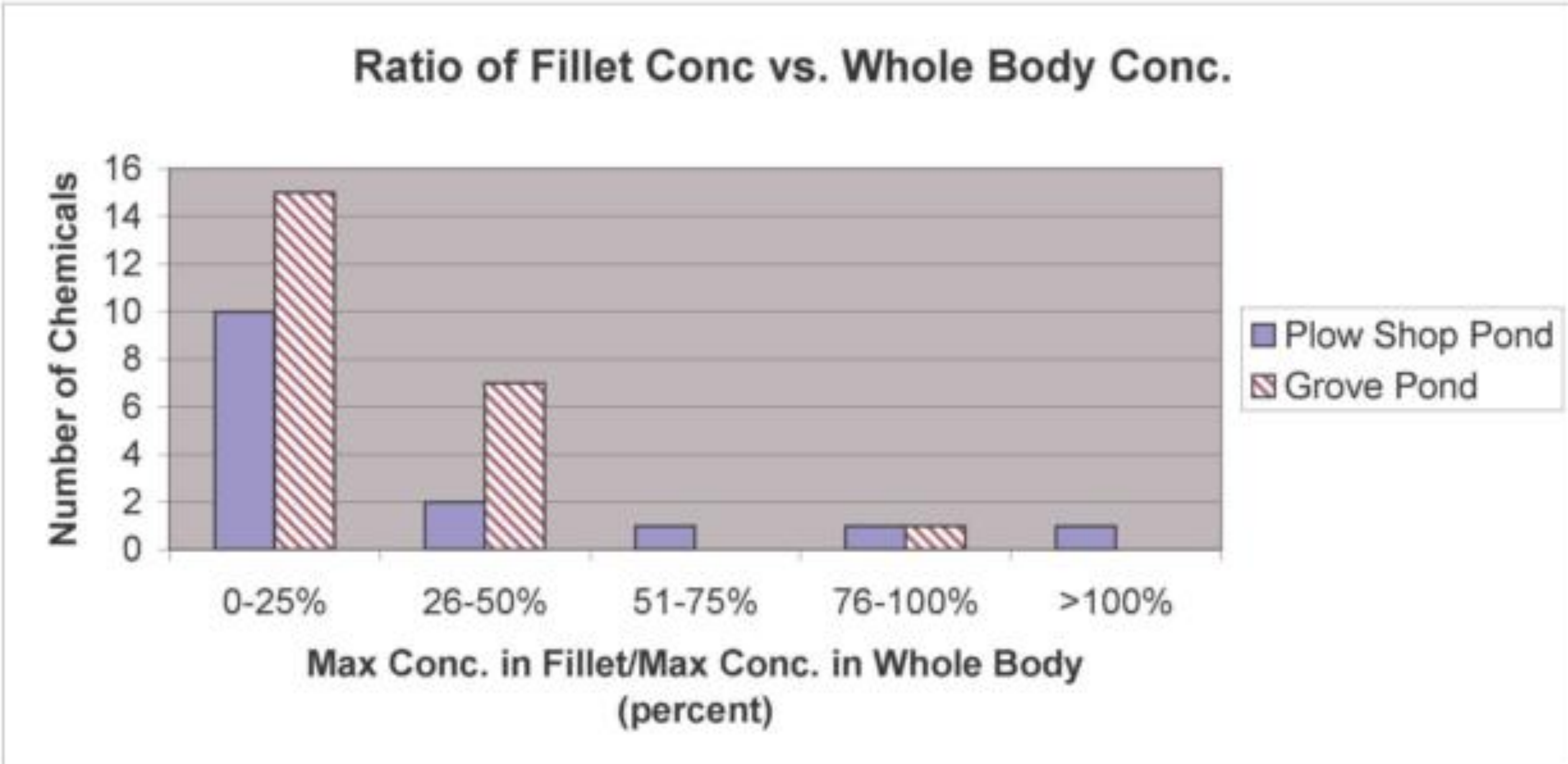

FIGURE 4
SELECTION OF EXPOSURE PATHWAYS
RAGS D TABLE 1
GROVE POND and PLOW SHOP POND

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	**Surface Water**	Surface Water	Grove Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
		Air	Volatilization of VOCs	Recreational User	Adult	Inhalation	None	This pathway presents a negligible risk to receptor. VOCs are not prevalent in pond surface water.
					Child	Inhalation	None	This pathway presents a negligible risk to receptor. VOCs are not prevalent in pond surface water.
	Near-shore Sediment	Sediment	Grove Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
	Fish	Fish	Grove Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to contaminants during fish consumption.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to contaminants during fish consumption.
Future	**Fish**	Fish	Grove Pond	Subsistence Fisherman	Adult	Ingestion	**Quant**	Currently there is no evidence that subsistence fishing occurs in this Pond. However, subsistence fishing, though unlikely, may occur at some point in the future.
					Child	Ingestion	**Quant**	Currently there is no evidence that subsistence fishing occurs in this Pond. However, subsistence fishing, though unlikely, may occur at some point in the future.

FIGURE 4
SELECTION OF EXPOSURE PATHWAYS
RAGS D TABLE 1
GROVE POND and PLOW SHOP POND

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	**Surface Water**	Surface Water	Plow Shop Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
		Air	Volatilization of VOCs	Recreational User	Adult	Inhalation	None	This pathway presents a negligible risk to receptor. VOCs are not prevalent in pond surface water.
					Child	Inhalation	None	This pathway presents a negligible risk to receptor. VOCs are not prevalent in pond surface water.
	Near-shore Sediment	Sediment	Plow Shop Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
	Fish	Fish	Plow Shop Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to contaminants during fish consumption.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to contaminants during fish consumption.
Future	**Fish**	Fish	Plow Shop Pond	Subsistence Fisherman	Adult	Ingestion	**Quant**	Currently there is no evidence that subsistence fishing occurs in this Pond. However, subsistence fishing, though unlikely, may occur at some point in the future.
					Child	Ingestion	**Quant**	Currently there is no evidence that subsistence fishing occurs in this Pond. However, subsistence fishing, though unlikely, may occur at some point in the future.

TABLES

TABLE 2-1
COMPARISION OF NEAR-SHORE SEDIMENT RESULTS WITH ALL SEDIMENT RESULTS
GROVE POND/PLOW SHOP POND
UNITS mg/kg

AOC	Detected Chemical	Max Detect		Min Detect		Avg Detect		Near shore Avg detect higher?	Percent	Near shore 2x higher?	Near shore 1.5x higher?	Near shore 1.25x higher?	Frequency of Detection	
		All	Near-shore	All	Near-shore	All	Near-shore						All	Near-shore
Grove Pond	Aluminum	90900	90900	0.54	1.1	1.04E+04	1.08E+04	yes	104.1	no	no	no	145 / 145	119 / 119
	Antimony	49.2	49.2	5	5	2.13E+01	2.04E+01	no	96.0	no	no	no	19 / 132	14 / 106
	Arsenic	1300	1300	2.96	2.96	8.63E+01	8.68E+01	yes	100.6	no	no	no	150 / 162	121 / 131
	Barium	470	470	7.4	7.4	8.68E+01	8.41E+01	no	96.9	no	no	no	124 / 143	101 / 117
	Beryllium	14.1	14.1	0.5	0.5	2.59E+00	2.85E+00	yes	109.8	no	no	no	37 / 137	31 / 111
	Cadmium	730	730	0.489	0.489	2.78E+01	2.51E+01	no	90.4	no	no	no	87 / 153	64 / 124
	Calcium	340000	170000	0.51	0.51	1.57E+04	1.21E+04	no	77.0	no	no	no	130 / 130	104 / 104
	Chromium, total	12000	52000	4.90	4.90	5.28E+03	5.44E+03	yes	103.1	no	no	no	154 / 159	125 / 130
	Cobalt	70	70	2.29	2.29	1.94E+01	1.77E+01	no	91.3	no	no	no	92 / 140	73 / 114
	Copper	13000	13000	2.61	2.61	1.42E+02	1.63E+02	yes	114.3	no	no	no	143 / 147	117 / 121
	Iron	42900	42900	0.97	2	1.39E+04	1.35E+04	no	97.1	no	no	no	145 / 145	119 / 119
	Lead	1700	1700	3.21	3.29	2.44E+02	2.47E+02	yes	101.4	no	no	no	151 / 159	127 / 130
	Magnesium	5300	5300	184	184	1.82E+03	1.75E+03	no	96.1	no	no	no	120 / 130	95 / 104
	Manganese	2500	2500	0.39	0.39	5.36E+02	4.77E+02	no	88.9	no	no	no	148 / 148	122 / 122
	Mercury	422	422	0.02452	0.02452	2.91E+01	3.31E+01	yes	114.0	no	no	no	108 / 134	84 / 105
	Nickel	99	99.0	1.98	1.98	2.99E+01	2.76E+01	no	92.3	no	no	no	129 / 145	105 / 119
	Potassium	4120	4120	109	109	1.02E+03	9.18E+02	no	90.0	no	no	no	60 / 130	46 / 104
	Selenium	41.2	41.2	0.424	0.424	9.20E+00	7.60E+00	no	80.6	no	no	no	47 / 140	39 / 114
	Silver	12.4	12.4	0.702	0.702	5.89E+00	5.40E+00	no	91.7	no	no	no	16 / 74	13 / 62
	Sodium	7920	6370	109	109	2.07E+03	1.90E+03	no	91.5	no	no	no	102 / 130	79 / 104
	Thallium	82.4	82.4	0.1	0.1	2.75E+01	2.21E+01	no	80.3	no	no	no	25 / 121	20 / 96
	Vanadium	140	140	5.1	5.1	3.56E+01	3.28E+01	no	92.3	no	no	no	112 / 141	92 / 115
	Zinc	820	770	3.12	3.12	2.58E+02	2.26E+02	no	87.5	no	no	no	140 / 149	116 / 123
	Mercury, methyl	0.07044	0.07044	0.00028	0.00028	2.44E-02	2.73E-02	yes	111.7	no	no	no	14 / 14	9 / 9
	Acenaphthene	1.3	1.3	0.019	0.019	3.07E-01	3.75E-01	yes	122.2	no	no	no	5 / 42	4 / 40
	Acenaphthylene	0.22	0.22	0.046	0.048	1.12E-01	1.29E-01	yes	114.6	no	no	no	5 / 99	4 / 83
	Anthracene	2.4	2.4	0.081	0.081	6.29E-01	6.81E-01	yes	108.3	no	no	no	11 / 99	10 / 83
	Benzo(a)anthracene	3.4	3.4	0.16	0.16	1.38E+00	1.51E+00	yes	109.4	no	no	no	10 / 99	9 / 83
	Benzo(a)pyrene	2.3	2.3	0.19	0.37	9.31E-01	1.04E+00	yes	111.4	no	no	no	8 / 42	7 / 40
	Benzo(b)fluoranthene	5	5	0.075	0.075	1.63E+00	1.84E+00	yes	113.0	no	no	no	7 / 31	6 / 25
	Benzo(ghi)perylene	1.4	1.4	0.028	0.064	8.07E-01	1.00E+00	yes	124.1	no	no	no	5 / 42	4 / 40
	Benzo(k)fluoranthene	4.9	4.9	0.11	0.21	1.30E+00	1.40E+00	yes	107.6	no	no	no	13 / 99	12 / 83
	Chrysene	5	5	0.051	0.051	1.59E+00	1.68E+00	yes	105.6	no	no	no	15 / 99	14 / 83
	Dibenz(a,h)anthracene	0.73	0.73	0.03	0.03	2.44E-01	3.40E-01	yes	139.3	no	no	yes	3 / 27	2 / 25
	Fluoranthene	7.1	7.1	0.06	0.06	2.12E+00	2.23E+00	yes	105.4	no	no	no	23 / 99	21 / 83
	Fluorene	1.1	1.1	0.049	0.049	4.41E-01	5.13E-01	yes	116.2	no	no	no	6 / 99	5 / 83
	Indeno(1,2,3-cd)pyrene	2.9	2.9	0.037	0.037	1.34E+00	1.34E+00	no	100.0	no	no	no	4 / 42	4 / 40
	Methylnaphthalene, 1-	1.1	1.1	1.1	1.1	1.10E+00	1.10E+00	no	100.0	no	no	no	1 / 15	1 / 15
	Methylnaphthalene, 2-	4	4	0.47	0.47	1.45E+00	1.45E+00	no	100.0	no	no	no	9 / 96	9 / 81
	Naphthalene	30	30	0.034	0.034	3.39E+00	3.40E+00	yes	100.4	no	no	no	27 / 99	23 / 83
	Phenanthrene	7.7	7.7	0.043	0.043	1.47E+00	1.51E+00	yes	102.6	no	no	no	24 / 99	23 / 83
	Pyrene	6.5	6.5	0.059	0.059	1.85E+00	1.94E+00	yes	104.8	no	no	no	30 / 99	28 / 83
	DDD, p,p'-	2.5	2.5	0.0087	0.0087	2.96E-01	3.04E-01	yes	102.9	no	no	no	44 / 100	40 / 84
	DDE, p,p'-	0.59	0.59	0.01	0.01	1.98E-01	2.04E-01	yes	103.4	no	no	no	47 / 100	35 / 84
	DDT, p,p'-	3.3	1.5	0.01	0.01	3.50E-01	2.69E-01	no	76.9	no	no	no	17 / 100	16 / 84
	Endrin	0.028	0.028	0.028	0.028	2.80E-02	2.80E-02	no	100.0	no	no	no	1 / 85	1 / 68
	Benzyl alcohol	19	19	1.7	1.7	1.04E+01	1.04E+01	no	100.0	no	no	no	2 / 24	2 / 23
	Bis(2-ethylhexyl) phthalate	4.9	4.9	0.41	0.41	2.66E+00	2.66E+00	no	100.0	no	no	no	2 / 16	2 / 15
	Bromophenyl phenyl ether, 4-	1.7	1.7	1.7	1.7	1.70E+00	1.70E+00	no	100.0	no	no	no	1 / 73	1 / 58
	Butylbenzyl phthalate	3	3	3	3	3.00E+00	3.00E+00	no	100.0	no	no	no	1 / 66	1 / 51
	Chlorophenyl phenyl ether, 4-	0.84	0.84	0.84	0.84	8.40E-01	8.40E-01	no	100.0	no	no	no	1 / 73	1 / 58
	Dibenzofuran	0.7	0.7	0.083	0.083	3.48E-01	3.48E-01	no	100.0	no	no	no	8 / 81	8 / 66
	Di-n-butyl phthalate	8	8	3.3	3.3	5.65E+00	5.65E+00	no	100.0	no	no	no	2 / 86	2 / 73
	Hexachlorobenzene	1.7	1.7	1.7	1.7	1.70E+00	1.70E+00	no	100.0	no	no	no	1 / 73	1 / 58
	Toluene	0.0042	0.0042	0.0042	0.0042	4.20E-03	4.20E-03	no	100.0	no	no	no	1 / 22	1 / 21
	Xylenes, total	0.0194	0.0194	0.0194	0.0194	1.94E-02	1.94E-02	no	100.0	no	no	no	1 / 22	1 / 21

TABLE 2-1
COMPARISION OF NEAR-SHORE SEDIMENT RESULTS WITH ALL SEDIMENT RESULTS
GROVE POND/PLOW SHOP POND
UNITS mg/kg

AOC	Detected Chemical	Max Detect		Min Detect		Avg Detect		Near shore Avg detect higher?	Percent	Near shore 2x higher?	Near shore 1.5x higher?	Near shore 1.25x higher?	Frequency of Detection	
		All	Near-shore	All	Near-shore	All	Near-shore						All	Near-shore
Plow Shop Pond	Aluminum	27000	27000	1	1	8.70E+03	8.75E+03	yes	100.7	no	no	no	189 / 189	130 / 130
	Antimony	30.7	30.7	5	5	1.17E+01	1.37E+01	yes	116.8	no	no	no	10 / 90	7 / 71
	Arsenic	6800	6800	0.11	0.11	3.90E+02	4.50E+02	yes	115.3	no	no	no	196 / 209	145 / 151
	Barium	370	370	0.16	0.27	8.22E+01	8.80E+01	yes	107.0	no	no	no	175 / 198	127 / 140
	Beryllium	5.41	5.41	0.4	0.4	1.54E+00	1.59E+00	yes	103.2	no	no	no	33 / 167	27 / 127
	Cadmium	69	66	0.792	0.792	1.63E+01	1.68E+01	yes	103.1	no	no	no	69 / 150	54 / 132
	Calcium	38000	34000	0.38	6.38	8.20E+03	8.09E+03	no	98.6	no	no	no	187 / 189	136 / 138
	Chromium, total	37800	37800	6.9	6.9	1.72E+03	1.46E+03	no	84.6	no	no	no	184 / 209	128 / 151
	Cobalt	59	59	1.5	1.98	1.48E+01	1.47E+01	no	99.4	no	no	no	82 / 170	67 / 128
	Copper	3450	3450	2.0	2.91	1.01E+02	1.20E+02	yes	118.5	no	no	no	140 / 152	110 / 141
	Iron	410000	410000	2.5	2.5	3.79E+04	4.65E+04	yes	122.8	no	no	no	189 / 189	138 / 138
	Lead	1214.31	1214.31	0.757	0.956	1.28E+02	1.37E+02	yes	107.8	no	no	no	160 / 200	128 / 151
	Magnesium	1580	8580	13.6	15.6	1.58E+03	1.59E+03	yes	100.4	no	no	no	174 / 189	129 / 138
	Manganese	54500	54800	16.9	31	1.64E+03	2.00E+03	yes	122.3	no	no	no	158 / 192	137 / 141
	Mercury	250	130	0.038	0.038	2.28E+01	1.62E+01	no	70.9	no	no	no	183 / 204	124 / 148
	Nickel	87.8	87.8	4	6.3	2.81E+01	2.74E+01	no	97.6	no	no	no	125 / 192	93 / 141
	Potassium	2340	2340	90.5	90.5	7.76E+02	7.56E+02	no	97.4	no	no	no	68 / 188	55 / 137
	Selenium	19.2	19.2	0.496	0.496	3.88E+00	4.04E+00	yes	104.3	no	no	no	54 / 163	31 / 128
	Silver	2	2	0.589	0.589	1.57E+00	1.45E+00	no	92.2	no	no	no	9 / 90	7 / 77
	Sodium	12000	4250	123	123	1.32E+03	1.10E+03	no	83.0	no	no	no	130 / 189	87 / 137
	Thallium	29.4	29.4	19.4	19.7	2.19E+01	2.33E+01	yes	106.6	no	no	no	5 / 64	3 / 55
	Tin	275	275	8.13	8.13	1.33E+02	1.33E+02	no	100.0	no	no	no	3 / 4	3 / 4
	Vanadium	169	166	3.2	3.2	3.39E+01	3.17E+01	no	93.7	no	no	no	61 / 189	78 / 138
	Zinc	1100	1100	9	9	2.01E+02	1.79E+02	no	89.4	no	no	no	122 / 192	95 / 141
	Mercury, methyl	0.69100	0.06530	0.00113	0.0057	3.67E-02	3.54E-02	no	96.7	no	no	no	10 / 10	8 / 8
	Acenaphthene	0.84	0.84	0.0093	0.0093	1.44E-01	1.84E-01	yes	127.5	no	no	yes	11 / 15	7 / 11
	Acenaphthylene	0.71	0.71	0.026	0.026	2.00E-01	1.88E-01	no	91.6	no	no	no	11 / 11	7 / 7
	Anthracene	3.4	3.4	0.038	0.038	5.62E-01	6.40E-01	yes	113.9	no	no	no	12 / 15	8 / 11
	Benz(a)anthracene	7.1	7.1	0.09	0.09	1.22E+00	1.34E+00	yes	109.1	no	no	no	13 / 28	9 / 23
	Benzo(a)pyrene	6.5	6.5	0.12	0.12	1.25E+00	1.37E+00	yes	109.4	no	no	no	11 / 11	7 / 7
	Benzo(b)fluoranthene	11	11	0.12	0.12	2.24E+00	2.23E+00	no	99.0	no	no	no	12 / 15	8 / 11
	Benzo(ghi)perylene	5.2	5.2	0.072	0.072	1.21E+00	1.20E+00	no	99.9	no	no	no	11 / 11	7 / 7
	Benzo(k)fluoranthene	3.7	3.7	0.071	0.071	7.97E-01	8.56E-01	yes	107.5	no	no	no	12 / 15	8 / 11
	Chrysene	8.1	8.1	0.032	0.032	1.66E+00	1.70E+00	yes	102.7	no	no	no	13 / 28	9 / 23
	Dibenz(a,h)anthracene	1.3	1.3	0.028	0.028	3.09E-01	3.26E-01	yes	105.5	no	no	no	11 / 11	7 / 7
	Fluoranthene	18	18	0.013	0.013	3.08E+00	3.26E+00	yes	105.4	no	no	no	14 / 20	10 / 20
	Fluorene	1.9	1.9	0.025	0.025	3.39E-01	3.64E-01	yes	107.4	no	no	no	12 / 15	8 / 11
	Indeno(1,2,3-cd)pyrene	4.5	4.5	0.048	0.048	1.04E+00	1.04E+00	yes	100.0	no	no	no	11 / 11	7 / 7
	Methylnaphthalene, 2-	2	2	1	1	1.67E+00	1.67E+00	no	100.0	no	no	no	3 / 4	3 / 4
	Naphthalene	2.4	2.4	0.024	0.024	7.62E-01	8.57E-01	yes	116.4	no	no	no	15 / 29	11 / 24
	Phenanthrene	10	10	0.13	0.13	1.70E+00	1.88E+00	yes	110.1	no	no	no	15 / 28	11 / 23
	Pyrene	14	14	0.24	0.24	2.55E+00	2.69E+00	yes	105.4	no	no	no	17 / 20	13 / 23
	PCB 1242	0.11	0.11	0.11	0.11	1.10E-01	1.10E-01	no	100.0	no	no	no	1 / 11	1 / 7
	PCB 1254	0.13	0.13	0.13	0.13	1.30E-01	1.30E-01	no	100.0	no	no	no	1 / 11	1 / 7
	PCB 1260	0.05	0.05	0.05	0.05	5.00E-02	5.00E-02	no	100.0	no	no	no	1 / 11	1 / 7
	DDD, p,p'-	1.8	1.8	0.013	0.013	2.03E-01	2.51E-01	yes	123.6	no	no	no	16 / 82	12 / 47
	DDE, p,p'	1.3	1.3	0.028	0.028	1.52E-01	1.75E-01	yes	114.9	no	no	no	21 / 100	16 / 67
	DDT, p,p'-	0.13	0.13	0.0033	0.0033	2.86E-02	3.42E-02	yes	119.4	no	no	no	10 / 50	8 / 35
	Heptachlor	0.002	0.002	0.002	0.002	5.00E-02	5.00E-02	no	100.0	no	no	no	2 / 24	2 / 19
	Dibenzofuran	2.8	0.8	0.4	0.4	8.00E-01	8.00E-01	no	100.0	no	no	no	2 / 4	2 / 4
	Acetone	2.6	0.54	0.059	0.058	5.23E-01	2.64E-01	no	50.4	no	no	no	9 / 14	6 / 13
	Methyl ethyl ketone	0.13	0.13	0.023	0.023	9.52E-02	9.02E-02	no	100.0	no	no	no	5 / 14	5 / 13
	Methylene chloride	0.12	0.12	0.021	0.021	6.02E-02	5.64E-02	no	93.7	no	no	no	11 / 14	10 / 13
	Trichlorofluoromethane	0.008	0.008	0.008	0.008	8.00E-03	8.00E-03	no	100.0	no	no	no	2 / 16	2 / 10

TABLE 2-2
COMPARISON OF FILLET TO WHOLE FISH TISSUE
GROVE POND

Chemical	Fillet Frequency of Detection			Fillet % Detected	Whole Body Frequency of Detection			Whole Body % Detected	Fillet Concentration Range (mg/kg-ww)			Whole Body Concentration Range (mg/kg-ww)			Ratio of Fillet Maximum Concentration to Whole Body Maximum Concentration
									Min		Max	Min		Max	(percent)
Aluminum	18	/	18	100%	30	/	32	94%	1.45	-	4.15	1.48	-	20.70	20%
Antimony					0	/	4	0%				(ND0.76	-	ND1.1)	
Arsenic	0	/	18	0%	2	/	32	6%	(ND0.078	-	ND 0.117)	0.13	-	0.13	
Barium	5	/	18	28%	32	/	32	100%	0.10	-	0.15	0.17	-	3.68	4%
Beryllium	4	/	18	22%	8	/	32	25%	0.03	-	0.14	0.07	-	0.99	14%
Boron	4	/	18	22%	15	/	28	54%	0.16	-	0.34	0.13	-	1.39	25%
Cadmium	5	/	18	28%	23	/	32	72%	0.03	-	0.15	0.03	-	1.02	15%
Calcium					0	/	4	0%				(ND1.5	-	ND2.3)	
Chromium, total	18	/	18	100%	32	/	32	100%	0.10	-	0.49	0.32	-	1.80	27%
Cobalt					0	/	4	0%				(ND0.23	-	ND0.34)	
Copper	18	/	18	100%	32	/	32	100%	0.11	-	0.60	0.30	-	1.35	44%
Iron	18	/	18	100%	32	/	32	100%	2.82	-	13.88	7.57	-	76.56	18%
Lead	8	/	18	44%	27	/	32	84%	0.10	-	0.86	0.16	-	5.02	17%
Magnesium	18	/	18	100%	32	/	32	100%	213.53	-	372.40	329.60	-	744.80	50%
Manganese	18	/	18	100%	32	/	32	100%	0.07	-	1.41	2.20	-	54.00	3%
Mercury	16	/	18	89%	29	/	32	91%	0.05	-	1.04	0.03	-	1.14	91%
Molybdenum	1	/	18	6%	6	/	28	21%	0.15	-	0.15	0.14	-	0.51	30%
Nickel	7	/	18	39%	15	/	32	47%	0.09	-	0.91	0.11	-	4.85	19%
Potassium					4	/	4	100%				3100.00	-	3400.00	0%
Selenium	13	/	18	72%	28	/	32	88%	0.10	-	0.18	0.14	-	0.55	32%
Silver					0	/	4	0%				(ND0.23	-	ND0.34)	
Sodium					4	/	4	100%				920.00	-	1500.00	0%
Strontium	18	/	18	100%	28	/	28	100%	0.15	-	4.24	11.68	-	48.48	9%
Thallium					0	/	4	0%				(ND1.5	-	ND2.3)	
Vanadium	2	/	18	11%	7	/	32	22%	0.12	-	0.16	0.12	-	0.92	18%
Zinc	18	/	18	100%	32	/	32	100%	3.63	-	7.95	10.54	-	42.00	19%
PCBs, total	5	/	18	28%	14	/	28	50%	0.07	-	0.15	0.09	-	0.47	32%
DDD, p,p'-	9	/	18	50%	31	/	32	97%	0.01	-	0.03	0.01	-	0.13	23%
DDE, p,p'-	15	/	18	83%	32	/	32	100%	0.01	-	0.07	0.01	-	0.27	26%

	Fillet	Whole Body
Average Percent Detected	60%	64%

		Number of Chemicals		
Percentile:	0-25%	15	Avg	23%
	26-50%	7	Min	0%
	51-75%	0	Max	91%
	76-100%	1	Median	19%
	>100%	0		

TABLE 2-3
COMPARISON OF FILLET TO WHOLE FISH TISSUE
PLOW SHOP POND

Chemical	Fillet Frequency of Detection			Fillet % Detected	Whole Body Frequency of Detection			Whole Body % Detected	Fillet Concentration Range (mg/kg ww)			Whole Body Concentration Range (mg/kg-ww)			Ratio of Fillet Maximum Concentration to Whole Body Maximum Concentration (percent)
									Min		Max	Min		Max	
Aluminum	0	/	10	0%	14	/	19	74%	ND(1.3	-	1.3)	1.6	-	4.5	
Antimony	0	/	10	0%	0	/	19	0%	ND(1.1	-	1.1)	ND(0.73	-	1.1)	
Arsenic	2	/	10	20%	2	/	19	11%	0.09	-	0.15	0.3	-	103	0%
Barium	0	/	10	0%	19	/	19	100%	ND(0.23	-	0.24)	0.27	-	4.4	
Beryllium	0	/	10	0%	0	/	19	0%	ND(0.04	-	0.04)	ND(0.04	-	0.089)	
Cadmium	0	/	10	0%	1	/	19	5%	ND(0.05	-	0.07)	0.09	-	0.09	
Calcium	10	/	10	100%	15	/	19	79%	82.8	-	627	3250	-	48800	1%
Chromium, total	2	/	10	20%	18	/	19	95%	0.19	-	0.24	0.25	-	0.99	24%
Cobalt	2	/	10	20%	5	/	19	26%	0.11	-	0.11	0.1	-	0.17	65%
Copper	10	/	10	100%	19	/	19	100%	0.08	-	0.24	0.29	-	1.3	18%
Iron	10	/	10	100%	19	/	19	100%	1.7	-	27	11	-	130	21%
Lead	0	/	10	0%	2	/	18	11%	ND(0.1	-	0.1)	0.16	-	0.18	
Magnesium	10	/	10	100%	19	/	19	100%	252	-	344	249	-	754	46%
Manganese	1	/	10	10%	19	/	19	100%	0.3	-	0.3	5.1	-	94.7	0%
Mercury	9	/	10	90%	18	/	19	95%	0.12	-	4	0.09	-	2.7	148%
Nickel	0	/	10	0%	1	/	19	5%	ND(0.75	-	0.8)	0.8	-	0.8	
Potassium					4	/	4					3100	-	3400	0%
Selenium	8	/	10	80%	14	/	19	74%	0.11	-	0.2	0.24	-	0.67	30%
Silver	0	/	10	0%	0	/	19	0%	ND(0.19	-	0.2)	ND(0.19	-	0.27)	
Sodium	10	/	10	100%	19	/	19	100%	283	-	509	1080	-	2290	22%
Thallium	0	/	10	0%	0	/	19	0%	ND(0.1	-	0.1)	ND(0.1	-	1.8)	
Vanadium	1	/	10	10%	1	/	19	5%	0.79	-	0.79	0.8	-	0.8	99%
Zinc	10	/	10	100%	19	/	19	100%	3.4	-	6.1	12.1	-	29.6	21%
PCB 1260	0	/	10	0%	5	/	19	26%	ND(0.048	-	0.1)	0.061	-	0.33	
DDD, p,p'-	0	/	10	0%	10	/	19	53%	ND(0.0095	-	0.021)	0.012	-	0.11	
DDE, p,p'-	2	/	10	20%	13	/	19	68%	0.015	-	0.031	0.015	-	0.38	8%
DDT, p,p'-	0	/	10	0%	3	/	19	16%	ND(0.0095	-	0.021)	0.012	-	0.014	
Average Percent Detected				Fillet 33%				Whole Body 52%							

	Number of Chemicals			
Percentile:	0-25%	10	Avg	34%
	26-50%	2	Min	0%
	51-75%	1	Max	148%
	76-100%	1	Median	21%
	>100%	1		

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Near-shore Sediment				
Grove Pond	1SC1	8/1/1999	Metals	Reference 54
Grove Pond	1SC2	8/1/1999	Metals	Reference 54
Grove Pond	1SC3	8/1/1999	Metals	Reference 54
Grove Pond	3SC2	8/1/1999	Metals	Reference 54
Grove Pond	3SC3	8/1/1999	Metals	Reference 54
Grove Pond	4SC1	8/1/1999	Metals	Reference 54
Grove Pond	5SC2	8/1/1999	Metals	Reference 54
Grove Pond	6SC1	8/1/1999	Metals	Reference 54
Grove Pond	8SC1	8/1/1999	Metals	Reference 54
Grove Pond	BHSO3	8/1/1999	Metals	Reference 54
Grove Pond	BM 1	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	BM 2	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	BM 3	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	BM 4	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	GP01	3/1/2004	Metals	study
Grove Pond	GP05	3/1/2004	Metals	study
Grove Pond	GP07	3/1/2004	Metals	study
Grove Pond	GP09	3/1/2004	Metals	study
Grove Pond	GP11	3/1/2004	Metals	study
Grove Pond	GP12	3/2/2004	Metals	study
Grove Pond	GP13	3/2/2004	Metals	study
Grove Pond	GP14	3/2/2004	Metals	study
Grove Pond	GP15	3/2/2004	Metals	study
Grove Pond	GP15 Dup	3/2/2004	Metals	study
Grove Pond	GPCORE1	9/1/2000	Metals	Reference 54
Grove Pond	GPCORE2	9/1/2000	Metals	Reference 54
Grove Pond	GPCORE3	9/1/2000	Metals	Reference 54
Grove Pond	GRD-92-01X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-92-02X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-92-03X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-92-04X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-92-05X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-95-08X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-09X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-12X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-15X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-16X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-17X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-19X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-20X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-22X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-23X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-24X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-24X Dup	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-25X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-26X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-27X	4/1/1995	Metals, Mercury, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-28X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-29X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-30X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-31X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-32X	4/1/1995	Metals, Mercury, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-32X Dup	4/1/1995	Metals, Mercury, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-35X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-36X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-37X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-38X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-39X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-40X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-41X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-42X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-43X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-44X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-45X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-46X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-47X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-48X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-49X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Grove Pond	GRD-95-53X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-54X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-55X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRS-95-01X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-02X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-03X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-04X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-05X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-06X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-07X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-08X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-08X Dup	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-09X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-10X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-11X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-12X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-13X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-14X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-15X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	G-SED-1	2/2/2005	Metals, PCBs/Pesticides, PAHs	study
Grove Pond	G-SED-3	2/2/2005	Metals, PCBs/Pesticides, PAHs	study
Grove Pond	G-SED-3 Dup	2/2/2005	Metals, PCBs/Pesticides, PAHs	study
Grove Pond	GSEM-1	9/11/1998	Metals	Reference 38 & 39
Grove Pond	GSEM-2	9/11/1998	Metals	Reference 38 & 39
Grove Pond	GSEM-4	9/11/1998	Metals	Reference 38 & 39
Grove Pond	GV1	1/1/2001	Metals	Reference 54
Grove Pond	GV10	1/1/2001	Metals	Reference 54
Grove Pond	GV5	1/1/2001	Metals	Reference 54
Grove Pond	GV6	1/1/2001	Metals	Reference 54
Grove Pond	GV7	1/1/2001	Metals	Reference 54
Grove Pond	GV8	1/1/2001	Metals	Reference 54
Grove Pond	GV9	1/1/2001	Metals	Reference 54
Grove Pond	MADEP A	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP B	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP C	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP D	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP E	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP F	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	PZ-1	8/4/1999	Metals, PCBs/Pesticides, SVOCs	Reference 40
Grove Pond	PZ-2	8/4/1999	Metals, PCBs/Pesticides, SVOCs	Reference 40
Grove Pond	S-1	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 6
Grove Pond	S-2	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 6
Grove Pond	S-3	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 6
Grove Pond	S-4	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 6
Grove Pond	SD-01	8/1/1999	Metals	Reference 54
Grove Pond	SD-03	8/1/1999	Metals	Reference 54
Grove Pond	SD-05	8/1/1999	Metals	Reference 54
Grove Pond	SD-06	8/1/1999	Metals	Reference 54
Grove Pond	SD-07	8/1/1999	Metals	Reference 54
Grove Pond	SD-08	8/1/1999	Metals	Reference 54
Grove Pond	SED-A	10/2/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-B	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-C	10/2/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-D	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-E	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-F	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-G	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 1	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 3	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 4	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 5	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 6	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 7	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-1	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-2	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-3	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-4	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Plow Shop Pond	PS1	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS2	1/1/2001	Metals	Reference 54

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Plow Shop Pond	PS4	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS5	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS7	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS8	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS9	1/1/2001	Metals	Reference 54
Plow Shop Pond	P-SED-1	2/1/2005	Metals, PCBs/Pesticides, PAHs	study
Plow Shop Pond	P-SED-11	2/1/2005	Metals, PCBs/Pesticides, PAHs	study
Plow Shop Pond	P-SED-2	2/1/2005	Metals, PCBs/Pesticides, PAHs	study
Plow Shop Pond	P-SED-3	2/1/2005	Metals, PCBs/Pesticides, PAHs	study
Plow Shop Pond	P-SED-4	2/1/2005	Metals, PCBs/Pesticides, PAHs	study
Plow Shop Pond	P-SED-8	2/1/2005	Metals, PCBs/Pesticides, PAHs	study
Plow Shop Pond	P-SED-9	2/1/2005	Metals, PCBs/Pesticides, PAHs	study
Plow Shop Pond	PSEM-1	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-2	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-3	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSP02	3/2/2004	Metals	study
Plow Shop Pond	PSP02 Dup	3/2/2004	Metals	study
Plow Shop Pond	PSP03	3/2/2004	Metals	study
Plow Shop Pond	PSP05	3/3/2004	Metals	study
Plow Shop Pond	PSP06	3/3/2004	Metals	study
Plow Shop Pond	PSP07	3/3/2004	Metals	study
Plow Shop Pond	PSP08	3/3/2004	Metals	study
Plow Shop Pond	PSP09	3/3/2004	Metals	study
Plow Shop Pond	PSPC05	3/5/2004	Metals	study
Plow Shop Pond	PSPC06	3/5/2004	Metals	study
Plow Shop Pond	PSPC06 Dup	3/5/2004	Metals	study
Plow Shop Pond	PSPC09	3/3/2004	Metals	study
Plow Shop Pond	PSPC10	3/3/2004	Metals	study
Plow Shop Pond	PSPC11	3/4/2004	Metals	study
Plow Shop Pond	PSPC12	3/4/2004	Metals	study
Plow Shop Pond	PSPC13	3/4/2004	Metals, VOCs	study
Plow Shop Pond	PSPC14	3/4/2004	Metals	study
Plow Shop Pond	PSPC15	3/5/2004	Metals	study
Plow Shop Pond	PSPC16	3/5/2004	Metals	study
Plow Shop Pond	PSPC17	3/5/2004	Metals	study
Plow Shop Pond	PSPC17 Dup	3/5/2004	Metals	study
Plow Shop Pond	PSPC18	3/5/2004	Metals	study
Plow Shop Pond	PSPC19	3/5/2004	Metals	study
Plow Shop Pond	PSPC19 Dup	3/5/2004	Metals	study
Plow Shop Pond	PSPCORE1	9/1/2000	Metals	Reference 54
Plow Shop Pond	PSPCORE2	9/1/2000	Metals	Reference 54
Plow Shop Pond	PSPCORE3	9/1/2000	Metals	Reference 54
Plow Shop Pond	RHD-94-02X	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	RHD-94-03X	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	RHD-94-03X Dup	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	RHD-94-04X	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	RHD-94-05X	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	SESHL01	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL02	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL03	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL04	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL05	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL06	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL07	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL08	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL09	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL10	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL11	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL12	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SHD-92-01X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-02X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-03X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-03X Dup	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-05X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-06X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-10X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-11X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-17X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-18X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Plow Shop Pond	SHD-92-19X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-20X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-22X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-23X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-26X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-27X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-28X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-29X	1/1/1993	Metals, PCBs/Pesticides, VOCs	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-30X	1/1/1993	Metals, PCBs/Pesticides, VOCs	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-31X	1/1/1993	Metals, PCBs/Pesticides, VOCs	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-32X	1/1/1993	Metals, PCBs/Pesticides, VOCs	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-94-01X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-02X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-03X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-05X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-06X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-07X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-09X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-14X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-15X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-18X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-20X	4/1/1995	Metals	Reference 21 (Table 4-6)
Surface Water				
Grove Pond	G1-2004	11/3/2004	Metals, PCBs/Pesticides	study
Grove Pond	G2-2004	11/3/2004	Metals, PCBs/Pesticides	study
Grove Pond	G2-2004 Dup	11/3/2004	Metals, PCBs/Pesticides	study
Grove Pond	G3-2004	11/3/2004	Metals, PCBs/Pesticides	study
Grove Pond	G4-2004	11/3/2004	Metals, PCBs/Pesticides	study
Grove Pond	G5-2004	11/3/2004	Metals, PCBs/Pesticides	study
Grove Pond	G6-2004	11/3/2004	Metals, PCBs/Pesticides	study
Grove Pond	GRW-95-06X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-07X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-08X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-09X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-09X Dup	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-10X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-11X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	SW001	8/25/1998	Metals	Reference 54
Grove Pond	SW001F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW002	8/25/1998	Metals	Reference 54
Grove Pond	SW002F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW003	8/25/1998	Metals	Reference 54
Grove Pond	SW003F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW004	8/25/1998	Metals	Reference 54
Grove Pond	SW004F	8/25/1998	Metals, Chloride, Nitrate, Sulfate	Reference 54
Grove Pond	SW005	8/25/1998	Metals	Reference 54
Grove Pond	SW005F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW006	8/25/1998	Metals	Reference 54
Grove Pond	SW006F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW008	8/25/1998	Metals	Reference 54
Grove Pond	SW008	2/24/1999	Metals, Chloride, Nitrate, Sulfate	Reference 54
Grove Pond	SW-A	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-B	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-C	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Grove Pond	SW-D	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-E	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-F	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-G	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Plow Shop Pond	PS1-2004	11/3/2004	Metals, PCBs/Pesticides	study
Plow Shop Pond	PS2-2004	11/3/2004	Metals, PCBs/Pesticides	study
Plow Shop Pond	PS3-2004	11/3/2004	Metals, PCBs/Pesticides	study
Plow Shop Pond	PS4-2004	11/3/2004	Metals, PCBs/Pesticides	study
Plow Shop Pond	PS5-2004	11/3/2004	Metals, PCBs/Pesticides	study
Plow Shop Pond	PS6-2004	11/3/2004	Metals, PCBs/Pesticides	study
Plow Shop Pond	PSEM-1	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-2	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-3	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-4	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	RCSW1	11/19/2004	Metals	study
Plow Shop Pond	RCSW2	11/19/2004	Metals	study
Plow Shop Pond	RCSW3	11/19/2004	Metals	study
Plow Shop Pond	RCSW4	11/19/2004	Metals	study
Plow Shop Pond	RED COVE	7/16/2004	Metals	study
Plow Shop Pond	SW-SHL-01	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-02	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-03	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-04	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-05	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-06	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-07	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-08	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-09	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-10	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-11	1/1/1991	Metals, PCBs/Pesticides	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-12	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-13	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Fish Tissue (fillets)				
Grove Pond	BBH1F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	BBH2F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	BBH3F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	BBH6F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB10F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB1F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB2F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB3F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB4F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB5F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB6F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB7F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB8F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB9F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	YBH4F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	YBH5F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	YBH7F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	YBH8F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Plow Shop Pond	PSP05F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP06F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP07F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP07F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP12F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP17F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP17F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP18F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP18F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP19F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP19F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP20F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP20F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP22F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP23F	10/20/1992	Metals, PCBs/Pesticides	Reference 6

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.

REFERENCES:

Number	Date	Company	Title	Prepared for:
5	1-Sep-93	US Fish and Wildlife	Concentrations of Mercury and other Environmental Contaminants in Fish from Grove Pond, Ayer, Massachusetts	
6	1-Dec-93	ABB-ES, Inc.	Final Remedial Investigation Addendum Report, Data Item A009, Volume I of IV, Report Text	US Army Environmental Center
8	1-Apr-94	ERM	Site Assessment Report, Boston & Maine Railroad Property, Fort Devens, Ayer, Massachusetts	Boston & Maine Corporation
11	1-Dec-94		Grove Pond Field Investigation	Metcalf & Eddy for MADEP
20	1-Sep-95	ABB-ES, Inc.	Railroad Roundhouse Supplemental Site Investigation, Data Item A009	US Army Environmental Center
21	1-Oct-95	ABB-ES, Inc.	Draft Plow Shop Pond and Grove Pond Sediment Evaluation, Data Item A009	US Army Environmental Center
32	1-Dec-97	TRC Environmental Corporation	Plow Shop Pond and Grove Pond Ecological Impact Evaluation, Fort Devens, Massachusetts	MADEP
38	1-Nov-98	EPA	Surface Water & Sediment Sampling Fort Devens Superfund Site Ayer, MA	ESAT
39	21-Jun-05	USEPA Region 1	USEPA Screening Level Ecological Risk Assessment, Fort Devens, Ayer, Massachusetts	
40	21-Oct-99	Environmental Compliance Services	Field Work and Analytical Results, PDC, Ayers	
54	1-May-99		Phase I Work Plan through March 2002 Grove Pond Arsenic Investigation	

TABLE 2-5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Near-shore Sediment	7429-90-5	Aluminum	1.1	90000	mg/kg	GRD-95-42X	119-119		90000	N/A	7600 (N)	N/A		**Yes**	ASL
	7440-36-0	Antimony	5	49.2	mg/kg	PZ-1	14-106	0.03-700	49	N/A	3.1 (N)	N/A		**Yes**	ASL
	7440-38-2	Arsenic	2.86	1300	mg/kg	GRD-95-26X	121-131	3.12-90	1300	N/A	0.39 (C)	N/A		**Yes**	ASL
	7440-39-3	Barium	7.4	470	mg/kg	GRD-95-27X	101-117	5.18-70	470	N/A	537 (N)	N/A		No	BSL
	7440-41-7	Beryllium	0.5	14.1	mg/kg	GRD-95-45X	31-111	0.5-14	14	N/A	15 (N)	N/A		No	BSL
	7440-43-9	Cadmium	0.489	730	mg/kg	BM 2	64-124	0.7-16	730	N/A	3.7 (N)	N/A		**Yes**	ASL
	7440-70-2	Calcium	0.51	170000	mg/kg	G-SED-3 Dup	104-104		170000	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	4.69	52000	mg/kg	GP15	125-130	4.05-28	52000	N/A	22 (N) [a]	N/A		**Yes**	ASL
	7440-48-4	Cobalt	2.29	70	mg/kg	SED-G	73-114	1.42-28	70	N/A	140 (N)	N/A		No	BSL
	7440-50-8	Copper	2.61	13000	mg/kg	BM 2	117-121	3-28	13000	N/A	310 (N)	N/A		**Yes**	ASL
	7439-89-6	Iron	2	42800	mg/kg	GRD-95-44X	119-119		42800	N/A	2300 (N)	N/A		**Yes**	ASL
	7439-92-1	Lead	3.29	1760	mg/kg	GRD-95-31X	122-130	10-70	1760	N/A	400 (X)	N/A		**Yes**	ASL
	7439-95-4	Magnesium	184	5300	mg/kg	GRD-95-41X	95-104	100-373	5300	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.39	2500	mg/kg	G-SED-3 Dup	122-122		2500	N/A	180 (N)	N/A		**Yes**	ASL
	7439-97-6	Mercury	0.0245	422	mg/kg	GRD-95-44X	84-108	0.05-1.8	422	N/A	2.3 (N)	N/A		**Yes**	ASL
	7440-02-0	Nickel	1.98	69.9	mg/kg	GRD-95-42X	105-119	1.71-70	69.9	N/A	160 (N)	N/A		No	BSL
	7440-09-7	Potassium	100	4120	mg/kg	SD-08	48-104	100-5600	4120	N/A	ND	N/A		No	NUT
	7782-49-2	Selenium	0.424	41.2	mg/kg	SD-08	39-114	0.25-100	41.2	N/A	39 (N)	N/A		**Yes**	ASL
	7440-22-4	Silver	0.792	12.4	mg/kg	SD-08	13-63	0.589-16	12.4	N/A	39 (N)	N/A		No	BSL
	7440-23-5	Sodium	100	6370	mg/kg	GRD-95-31X	79-104	98-5600	6370	N/A	ND	N/A		No	NUT
	7440-28-0	Thallium	0.1	82.4	mg/kg	SD-08	20-95	0.1-110	82.4	N/A	0.52 (N)	N/A		**Yes**	ASL
	7440-62-2	Vanadium	5.1	140	mg/kg	GP14, GP15	92-115	2.8-65.9	140	N/A	7.8 (N)	N/A		**Yes**	ASL
	7440-66-6	Zinc	3.12	770	mg/kg	GP12	116-123	8.03-8.03	770	N/A	2300 (N)	N/A		No	BSL
	22967926	Mercury, methyl	0.00028	0.07044	mg/kg	GV5	9-9		0.07044	N/A	0.61 (N)	N/A		No	BSL
	83-32-9	Acenaphthene	0.019	1.3	mg/kg	GRS-95-11X	4-40	0.036-2	1.3	N/A	370 (N)	N/A		No	BSL
	208-96-8	Acenaphthylene	0.048	0.22	mg/kg	G-SED-1	4-83	0.033-2	0.22	N/A	370 (N) [b]	N/A		No	FREQ
	120-12-7	Anthracene	0.081	2.4	mg/kg	GRD-95-15X	10-83	0.033-2	2.4	N/A	2200 (N)	N/A		No	BSL
	56-55-3	Benz(a)anthracene	0.19	3.4	mg/kg	GRD-95-15X	9-83	0.13-7	3.4	N/A	0.62 (C)	N/A		**Yes**	ASL
	50-32-8	Benzo(a)pyrene	0.37	2.3	mg/kg	GRS-95-11X	7-40	0.13-2.7	2.3	N/A	0.062 (C)	N/A		**Yes**	ASL
	205-99-2	Benzo(b)fluoranthene	0.075	5	mg/kg	GRS-95-07X	6-75	0.13-8	5	N/A	0.62 (C)	N/A		**Yes**	ASL
	191-24-2	Benzo(ghi)perylene	0.084	1.4	mg/kg	SW-1	4-40	0.13-3.6	1.4	N/A	230 (N) [c]	N/A		No	BSL
	207-08-9	Benzo(k)fluoranthene	0.21	4.9	mg/kg	SW-1	12-83	0.066-3	4.9	N/A	6.2 (C)	N/A		**Yes**	PAHc
	218-01-9	Chrysene	0.051	5	mg/kg	GRS-95-07X	14-83	0.12-5	5	N/A	62 (C)	N/A		**Yes**	PAHc

TABLE 2-5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Near-shore Sediment	53-70-3	Dibenz(ah)anthracene	0.03	0.73	mg/kg	G-SED-3 Dup	2-25	0.13-3.4	0.73	N/A	0.062 (C)	N/A		**Yes**	ASL
	206-44-0	Fluoranthene	0.06	7.1	mg/kg	SW-1	21-83	0.068-3	7.1	N/A	230 (N)	N/A		No	BSL
	86-73-7	Fluorene	0.049	1.1	mg/kg	GRD-95-15X, GRS-95-11X	5-83	0.033-2	1.1	N/A	270 (N)	N/A		No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	0.037	2.9	mg/kg	G-SED-3 Dup	4-40	0.13-3.4	2.9	N/A	0.62 (C)	N/A		**Yes**	ASL
	90-12-0	Methylnaphthalene, 1-	1.1	1.1	mg/kg	S-2	1-15	0.5-5	1.1	N/A	5.6 (N) #	N/A		No	BSL
	91-57-6	Methylnaphthalene, 2-	0.47	4	mg/kg	GRD-95-12X	9-81	0.049-2	4	N/A	5.6 (N) #	N/A		No	BSL
	91-20-3	Naphthalene	0.034	30	mg/kg	GRD-95-26X	23-83	0.037-2	30	N/A	5.6 (N)	N/A		**Yes**	ASL
	85-01-8	Phenanthrene	0.043	7.7	mg/kg	GRS-95-11X	23-83	0.033-2	7.7	N/A	2200 (N) *	N/A		No	BSL
	129-00-0	Pyrene	0.059	6.5	mg/kg	GRS-95-11X	28-83	0.03-2	6.5	N/A	230 (N)	N/A		No	BSL
	72-54-8	DDD, p,p'-	0.0087 (C)	2.5 (C)	mg/kg	GRD-95-47X	40-84	0.0083-0.36	2.5	N/A	2.4 (C)	N/A		**Yes**	ASL
	72-55-9	DDE, p,p'-	0.01	0.98 (C,M)	mg/kg	GRD-95-31X, GRD-95-31X	39-84	0.0034-0.36	0.98	N/A	1.7 (C)	N/A		No	BSL
	50-29-3	DDT, p,p'-	0.01	1.5 (C,M)	mg/kg	GRD-95-29X	16-84	0.0033-0.36	1.5	N/A	1.7 (C)	N/A		No	BSL
	72-20-8	Endrin	0.028	0.028	mg/kg	GRD-95-31X	1-69	0.0033-0.36	0.028	N/A	1.8 (N)	N/A		No	FREQ
	100-51-6	Benzyl alcohol	1.7	19	mg/kg	GRS-95-11X	2-23	0.19-4.1	19	N/A	1800 (N)	N/A		No	BSL
	117-81-7	Bis(2-ethylhexyl) phthalate	0.41	4.9	mg/kg	PZ-1	2-15	0.13-2	4.9	N/A	35 (C)	N/A		No	BSL
	101-55-3	Bromophenyl phenyl ether, 4-	1.7	1.7	mg/kg	GRD-95-15X	1-58	0.033-2	1.7	N/A	ND	N/A		No	FREQ
	85-68-7	Butylbenzyl phthalate	3	3	mg/kg	GRD-95-15X	1-51	0.13-7	3	N/A	1200 (N)	N/A		No	FREQ
	7005-72-3	Chlorophenyl phenyl ether, 4-	0.84	0.84	mg/kg	GRD-95-15X	1-58	0.033-2	0.84	N/A	ND	N/A		No	FREQ
	132-64-9	Dibenzofuran	0.063	0.7	mg/kg	GRS-95-07X	6-66	0.035-9.8	0.7	N/A	15 (N)	N/A		No	BSL
	84-74-2	Di-n-butyl phthalate	3.3	8	mg/kg	GRS-95-09X	2-73	0.061-3	8	N/A	610 (N)	N/A		No	FREQ
	118-74-1	Hexachlorobenzene	1.7	1.7	mg/kg	GRD-95-15X	1-58	0.033-2	1.7	N/A	0.30 (C)	N/A		No	FREQ
	108-88-3	Toluene	0.0042	0.0042	mg/kg	SEDIMENT 3	1-21	0.002-0.054	0.0042	N/A	66 (N)	N/A		No	FREQ
	1330-20-7	Xylenes, total	0.0164	0.0164	mg/kg	SEDIMENT 1	1-21	0.002-0.036	0.0164	N/A	27 (N)	N/A		No	FREQ

Notes:

(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: C = unknown
M = unknown

(2) Screening concentration = maximum detected concentration.

(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.

(4) U.S. EPA Region IX Preliminary Remedial Goals (PRGs) for residential soil, December 28, 2004.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)
X = special health-based value not based on carcinogenic/noncarcinogenic endpoints.

Definitions: ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.
ND = not determined.

TABLE 2-5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)

(5) Rationale Codes
Selection Reason: ASL = above screening level.
PAHc = carcinogenic PAH (although screening concentration < screening toxicity value, included as COPC due to the cumulative nature of carcinogenic PAHs).
Deletion Reason: BSL = below screening level.
FREQ = frequency of detection (chemical detected in less than 5 percent of samples).
NUT = essential nutrient.

Additional Notes:
[a] PRG for hexavalent chromium.
[b] PRG for acenaphthene used as a surrogate.
[c] PRG for pyrene used as a surrogate.
[d] PRG for naphthalene used as a surrogate.
[e] PRG for anthracene used as a surrogate.

TABLE 2-6

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

GROVE POND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

1.04

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Water	7429-90-5	Aluminum	0.008 (J)	28-28 [illegible]5	mg/L	SW001	15-24	0.05-10	0.176	N/A	3.6 (N)	N/A		No	BSL
	7440-38-2	Arsenic	0.000001	[illegible]	mg/L	PZ-2	18-34	0.00254-10	0.128	N/A	0.000045 (C)	N/A		**Yes**	ASL
	7440-39-3	Barium	0.00637	11.9	mg/L	GSEM-2	22-30	0.005-0.01	11.9	N/A	0.26 (N)	N/A		**Yes**	ASL
	7440-70-2	Calcium	0.0088	SW004 [illegible]0	mg/L	GSEM-2	30-30		19700	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	0.0008 (J)	[illegible]5	mg/L	PZ-1R	12-34	0.003-3	0.175	N/A	0.011 (N)[a]	N/A		**Yes**	ASL
	7440-48-4	Cobalt	0.00028	0.00043	mg/L	G6-2004	3-24	0.0002-1.5	0.00043	N/A	0.073 (N)	N/A		No	BSL
	7440-50-8	Copper	0.001 (J)	0.032	mg/L	G2-2004 Dup	8-34	0.0015-1.5	0.032	N/A	0.15 (N)	N/A		No	BSL
	7439-89-6	Iron	0.00012	390	mg/L	GSEM-1	30-30		390	N/A	1.1 (N)	N/A		**Yes**	ASL
	7439-92-1	Lead	0.0003 (J)	[illegible]7	mg/L	PZ-1	10-34	0.001-5	0.027	N/A	ND	N/A		**Yes**	NSL
	7439-95-4	Magnesium	0.0017	1.04 [illegible]	mg/L	GSEM-2	30-30		3300	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.01	[illegible]	mg/L	GSEM-2	30-30		268	N/A	0.088 (N)	N/A		**Yes**	ASL
	7439-97-6	Mercury	0.0011	0.0011	mg/L	PZ-1	1-23	0.0005-0.001	0.0011	N/A	0.0011 (N)	N/A		No	FREQ
	7440-02-0	Nickel	0.001	0.032	mg/L	PZ-1R	7-28	0.005-6	0.032	N/A	0.073 (N)	N/A		No	BSL
	14797-55-8	Nitrate	0.07	0.3	mg/L	SW-1	3-3		0.3	N/A	1.0 (N)	N/A		No	BSL
		Nitrogen, NO2+NO3	0.0195	0.26	mg/L	GRW-95-10X	5-6	0.01-0.01	0.26	N/A	0.1 (N)[b]	N/A		**Yes**	ASL
	7440-09-7	Potassium	0.0013	2500	mg/L	GSEM-1	24-24		2500	N/A	ND	N/A		No	NUT
	7440-23-5	Sodium	0.0224	30500	mg/L	GSEM-1	24-24		30500	N/A	ND	N/A		No	NUT
	7440-66-6	Zinc	0.005 (J)	9.11	mg/L	PZ-1	11-28	0.006-12	9.11	N/A	1.1 (N)	N/A		**Yes**	ASL
	117-81-7	Bis(2-ethylhexyl) phthalate	0.009	0.051	mg/L	GRW-95-06X	6-13	0.0048-0.01	0.051	N/A	0.0048 (C)	N/A		**Yes**	ASL

Notes:
(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: J = estimated
(2) Screening concentration = maximum detected concentration.
(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.
(4) U.S. EPA Region IX Preliminary Remedial Goals (PRGs) for tap water, December 28, 2004.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)
(5) Rationale Codes
Selection Reason: ASL = above screening level.
NSL = no screening level available.
Deletion Reason: BSL = below screening level.
FREQ = frequency of detection (chemical detected in less than 5 percent of samples).
NUT = essential nutrient.

Definitions: ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.
ND = not determined.

Additional Notes:
[a] PRG for hexavalent chromium.
[b] PRG for nitrite used as a surrogate.

TABLE 2-7

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

GROVE POND

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish (fist)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Fish (fist)	7429-90-5	Aluminum	1.45	4.15	mg/kg-ww	Y0811F	18-18		4.15	N/A	140 (N)	N/A		No	BSL
	7440-39-3	Barium	0.008	0.147	mg/kg-ww	Y0811F	1-18	0.06-0.139	0.147	N/A	9.5 (N)	N/A		No	BSL
	7440-41-7	Beryllium	0.031	0.14	mg/kg-ww	LM706F	4-18	0.016-0.022	0.14	N/A	0.27 (N)	N/A		No	BSL
	7440-42-8	Boron	0.162	0.343	mg/kg-ww	LM754F	4-18	0.08-0.105	0.343	N/A	27 (N)	N/A		No	BSL
	7440-43-9	Cadmium	0.025	0.151	mg/kg-ww	LM803F	5-18	0.016-0.023	0.151	N/A	0.14 (N)	N/A		Yes	ASL
	7440-47-3	Chromium, total	0.1	0.488	mg/kg-ww	LM734F	18-18		0.488	N/A	0.41 (N)[a]	N/A		Yes	ASL
	7440-50-8	Copper	0.111	0.337	mg/kg-ww	Y0816F	18-18		0.337	N/A	5.4 (N)	N/A		No	BSL
	7439-89-6	Iron	2.82	13.9	mg/kg-ww	Y0847F	18-18		13.9	N/A	41 (N)	N/A		No	BSL
	7439-92-1	Lead	0.0983	0.859	mg/kg-ww	LM734F	5-18	0.0797-0.1076	0.859	N/A	ND	N/A		Yes	NSL
	7439-95-4	Magnesium	214	372	mg/kg-ww	LM789F	18-18		372	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.0715	1.41	mg/kg-ww	LM812F	18-18		1.41	N/A	2.7 (N)	N/A		No	BSL
	7439-97-6	Mercury	0.0522	1.04	mg/kg-ww	LM701F	16-18	0.0179-0.0188	1.04	N/A	0.041 (N)[b]	N/A		Yes	ASL
	7439-98-7	Molybdenum	0.154	0.154	mg/kg-ww	LM803F	1-18	0.0797-0.1097	0.154	N/A	0.68 (N)	N/A		No	BSL
	7440-02-0	Nickel	0.092	0.507	mg/kg-ww	LM803F	7-18	0.0797-0.1086	0.507	N/A	2.7 (N)	N/A		No	BSL
	7782-49-2	Selenium	0.0391	0.179	mg/kg-ww	LM811F	13-18	0.0503-0.0675	0.179	N/A	0.68 (N)	N/A		No	BSL
	7440-24-6	Strontium	0.150	4.21	mg/kg-ww	Y0812F	18-18		4.21	N/A	81 (N)	N/A		No	BSL
	7440-62-2	Vanadium	0.124	0.164	mg/kg-ww	LM803F	2-18	0.0797-0.1085	0.164	N/A	0.14 (N)	N/A		Yes	ASL
	7440-66-6	Zinc	3.63	7.95	mg/kg-ww	Y0842F	18-18		7.95	N/A	41 (N)	N/A		No	BSL
	1336-36-3	PCBs, total	0.07	0.15	mg/kg-ww	LM82F	5-18	0.05-0.05	0.15	N/A	0.0016 (C)	N/A		Yes	ASL
	72-54-8	DDD, p,p'-	0.01	0.03	mg/kg-ww	LM82F, LM84F	5-18	0.01-0.01	0.03	N/A	0.013 (C)	N/A		Yes	ASL
	72-55-9	DDE, p,p'-	0.01	0.07	mg/kg-ww	LM82F	15-18	0.01-0.01	0.07	N/A	0.0093 (C)	N/A		Yes	ASL

Notes:

(1) Minimum/maximum concentration in data determined to be usable for risk assessment.

(2) Screening concentration = maximum detected concentration.

(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.

(4) U.S. EPA Region III Risk Based Concentrations (RBCs) for fish ingestion, April 7, 2005

Value Type: C = carcinogenic (target risk = 1e-6)

N = noncarcinogenic (target HI = 0.1)

(5) Rationale Codes

Selection Reason: ASL = above screening level

Deletion Reason: BSL = below screening level

NUT = essential nutrient

NSL = No Screening Levels

Additional Notes:

[a] RBC for hexavalent chromium

[b] RBC for mercuric chloride

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

COPC = Chemical of Potential Concern

N/A = not applicable

ND = not determined

TABLE 2-8

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Near-shore Sediment	7429-90-5	Aluminum	1	27000	mg/kg	P-SED-3, PSPC14	135-135		27000	N/A	7600 (N)	N/A		**Yes**	ASL
	7440-36-0	Antimony	5	30.7	mg/kg	SHD-94-03X	7-71	1.09-500	30.7	N/A	3.1 (N)	N/A		**Yes**	ASL
	7440-38-2	Arsenic	0.11	6800	mg/kg	PSPC14	140-148	10-50	6800	N/A	0.39 (C)	N/A		**Yes**	ASL
	7440-39-3	Barium	0.27	370	mg/kg	PSPC14	125-137	5.18-15	370	N/A	537 (N)	N/A		No	BSL
	7440-41-7	Beryllium	0.4	5.41	mg/kg	SHD-92-03X Dup	27-124	0.078-50	5.41	N/A	15 (N)	N/A		No	BSL
	7440-43-9	Cadmium	0.792	66 (J2)	mg/kg	PSPC14	54-129	0.0044-150	66	N/A	3.7 (N)	N/A		**Yes**	ASL
	7440-70-2	Calcium	0.39	34000	mg/kg	PSPC13	133-135	1300-1300	34000	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	6.9	37800	mg/kg	SESHL02	135-148	0.0074-150	37800	N/A	22 (N)[a]	N/A		**Yes**	ASL
	7440-48-4	Cobalt	1.98	59	mg/kg	PSPC13	67-123	1.42-150	59	N/A	140 (N)	N/A		No	BSL
	7440-50-8	Copper	2.91	3450	mg/kg	RHD-94-02X	107-138	0.965-150	3450	N/A	310 (N)	N/A		**Yes**	ASL
	7439-89-6	Iron	2.5	410000	mg/kg	PSP06	135-135		410000	N/A	2300 (N)	N/A		**Yes**	ASL
	7439-92-1	Lead	0.958	1214.31	mg/kg	PS1	125-148	0.064-500	1214.31	N/A	400 (X)	N/A		**Yes**	ASL
	7439-95-4	Magnesium	13.6	8580	mg/kg	SHD-94-15X	126-135	100-100	8580	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	31	54800	mg/kg	SHD-92-02X	134-138	2.05-84	54800	N/A	180 (N)	N/A		**Yes**	ASL
	7439-97-6	Mercury	0.038	130	mg/kg	SESHL11	123-145	0.00018-0.05	130	N/A	2.3 (N)	N/A		**Yes**	ASL
	7440-02-0	Nickel	6.3	87.8	mg/kg	SHD-94-03X	91-138	1.71-300	87.8	N/A	160 (N)	N/A		No	BSL
	7440-09-7	Potassium	90.5	2340	mg/kg	SESHL08	54-134	100-50000	2340	N/A	ND	N/A		No	NUT
	7782-49-2	Selenium	0.496	19.2	mg/kg	SHD-92-20X	31-125	0.1-1000	19.2	N/A	39 (N)	N/A		No	BSL
	7440-22-4	Silver	0.589	2	mg/kg	PSEM-1, PSEM-2, PSEM-3	7-77	0.0061-150	2	N/A	39 (N)	N/A		No	BSL
	7440-23-5	Sodium	123	4280	mg/kg	SHD-94-14X	84-134	52-50000	4280	N/A	ND	N/A		No	NUT
	7440-28-0	Thallium	19.7	29.4	mg/kg	PSEM-1	3-56	18-1000	29.4	N/A	0.52 (N)	N/A		**Yes**	ASL
	7440-31-5	Tin	8.13	275	mg/kg	RHD-94-02X	3-4	4.9-4.9	275	N/A	4700 (N)	N/A		No	BSL
	7440-62-2	Vanadium	3.2	166	mg/kg	SESHL10	78-135	3.39-150	166	N/A	7.8 (N)	N/A		**Yes**	ASL
	7440-66-6	Zinc	9 (B)	1100	mg/kg	P-SED-9	94-138	8.03-150	1100	N/A	2300 (N)	N/A		No	BSL
	22967926	Mercury, methyl	0.0057	0.06538	mg/kg	PS1	8-8		0.06538	N/A	0.61 (N)	N/A		No	BSL
	83-32-9	Acenaphthene	0.0063 (J)	0.84	mg/kg	P-SED-9	7-11	0.0091-0.2	0.84	N/A	370 (N)	N/A		No	BSL
	208-96-8	Acenaphthylene	0.026	0.71	mg/kg	P-SED-9	7-7		0.71	N/A	370 (N)[b]	N/A		No	BSL
	120-12-7	Anthracene	0.038	3.4	mg/kg	P-SED-9	8-11	0.2-0.2	3.4	N/A	2200 (N)	N/A		No	BSL
	56-55-3	Benz(a)anthracene	0.09	7.1	mg/kg	P-SED-9	9-23	0.3-0.8	7.1	N/A	0.62 (C)	N/A		**Yes**	ASL
	50-32-8	Benzo(a)pyrene	0.12	6.5	mg/kg	P-SED-9	7-7		6.5	N/A	0.062 (C)	N/A		**Yes**	ASL
	205-99-2	Benzo(b)fluoranthene	0.12	11	mg/kg	P-SED-9	8-11	1-1	11	N/A	0.62 (C)	N/A		**Yes**	ASL
	191-24-2	Benzo(ghi)perylene	0.072	5.2	mg/kg	P-SED-9	7-7		5.2	N/A	230 (N)[c]	N/A		No	BSL
	207-08-9	Benzo(k)fluoranthene	0.071	3.7	mg/kg	P-SED-9	8-11	0.3-0.3	3.7	N/A	6.2 (C)	N/A		**Yes**	PAHc

TABLE 2-8

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Near-shore Sediment	218-01-9	Chrysene	0.032	8.1	mg/kg	P-SED-9	9-23	0.45-0.6	8.1	N/A	62 (C)	N/A		**Yes**	PAHc
	53-70-3	Dibenz(ah)anthracene	0.028	1.3	mg/kg	P-SED-9	7-7		1.3	N/A	0.062 (C)	N/A		**Yes**	ASL
	206-44-0	Fluoranthene	0.013	18	mg/kg	P-SED-9	10-23	0.3-0.52	18	N/A	230 (N)	N/A		No	BSL
	86-73-7	Fluorene	0.025	1.9	mg/kg	P-SED-9	8-11	0.2-0.2	1.9	N/A	270 (N)	N/A		No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	0.048	4.5	mg/kg	P-SED-9	7-7		4.5	N/A	0.62 (C)	N/A		**Yes**	ASL
	91-57-6	Methylnaphthalene, 2-	1	2	mg/kg	RHD-94-02X, RHD-94-03X, RHD-94-03X Dup	3-4	0.2-0.2	2	N/A	5.6 (N)[#]	N/A		No	BSL
	91-20-3	Naphthalene	0.024	2.4	mg/kg	P-SED-9	11-24	0.089-0.42	2.4	N/A	5.6 (N)	N/A		No	BSL
	85-01-8	Phenanthrene	0.13	10	mg/kg	P-SED-9	11-23	0.2-0.41	10	N/A	2200 (N)*	N/A		No	BSL
	129-00-0	Pyrene	0.24	14	mg/kg	P-SED-9	13-23	0.2-0.42	14	N/A	230 (N)	N/A		No	BSL
	53469-21-9	PCB 1242	0.11 (J)	0.11 (J)	mg/kg	P-SED-3	1-7	0.053-0.13	0.11	N/A	0.11 (N)	N/A		No	BSL
	11097-69-1	PCB 1254	0.13	0.13	mg/kg	P-SED-3	1-7	0.053-0.13	0.13	N/A	0.11 (N)	N/A		**Yes**	ASL
	11096-82-5	PCB 1260	0.05	0.05	mg/kg	P-SED-3	1-7	0.053-0.13	0.05	N/A	0.11 (N)	N/A		No	BSL
	72-54-8	DDD, p,p'-	0.013	1.8	mg/kg	SHD-92-02X	12-44	0.008-0.008	1.8	N/A	2.4 (C)	N/A		No	BSL
	72-55-9	DDE, p,p'-	0.028	1.3	mg/kg	SHD-92-02X	16-64	0.008-0.076	1.3	N/A	1.7 (C)	N/A		No	BSL
	50-29-3	DDT, p,p'-	0.0033 (J)	0.13	mg/kg	SHD-92-28X	8-52	0.0017-0.071	0.13	N/A	1.7 (C)	N/A		No	BSL
	76-44-8	Heptachlor	0.02	0.092	mg/kg	SESHL03	2-19	0.0017-0.012	0.092	N/A	0.11 (C)	N/A		No	BSL
	132-64-9	Dibenzofuran	0.4	0.8	mg/kg	RHD-94-03X, RHD-94-03X Dup	2-4	0.2-0.2	0.8	N/A	15 (N)	N/A		No	BSL
	67-64-1	Acetone	0.058	0.54	mg/kg	SESHL05	8-13	0.01-0.089	0.54	N/A	1400 (N)	N/A		No	BSL
	78-93-3	Methyl ethyl ketone	0.023	0.13	mg/kg	SESHL05, SESHL09	5-13	0.01-0.089	0.13	N/A	2200 (N)	N/A		No	BSL
	75-09-2	Methylene chloride	0.021	0.12	mg/kg	SESHL09	10-13	0.006-0.089	0.12	N/A	9.1 (C)	N/A		No	BSL
	75-69-4	Trichlorofluoromethane	0.008	0.008	mg/kg	SHD-92-30X	2-16	0.006-0.089	0.008	N/A	39 (N)	N/A		No	BSL

Notes:

(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: B = constituent present in associated blank
J = estimated
J2 = estimated

(2) Screening concentration = maximum detected concentration.

(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.

(4) U.S. EPA Region IX Preliminary Remedial Goals (PRGs) for residential soil, December 28, 2004.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)
X = special health-based value not based on carcinogenic/noncarcinogenic endpoints.

Definitions: ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable

TABLE 2-8

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)

(5) Rationale Codes

Selection Reason: ASL = above screening level.

PAHc = carcinogenic PAH (although screening concentration < screening toxicity value, included as COPC due to the cumulative nature of carcinogenic PAHs).

Deletion Reason: BSL = below screening level.

NUT = essential nutrient.

Additional Notes:

[a] PRG for hexavalent chromium.

[b] PRG for acenaphthene used as a surrogate.

[c] PRG for pyrene used as a surrogate.

[d] PRG for naphthalene used as a surrogate.

[e] PRG for anthracene used as a surrogate.

TABLE 2-9

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Water	7429-90-5	Aluminum	0.008 (J)	0.035	mg/L	RED COVE	7-15	0.01-0.02	0.035	N/A	3.6 (N)	N/A		No	BSL
	7440-38-2	Arsenic	0.0014	0.38	mg/L	RED COVE	19-28	0.001-0.01	0.38	N/A	0.000045 (C)	N/A		**Yes**	ASL
	7440-39-3	Barium	0.00335	0.044	mg/L	RED COVE	28-28		0.044	N/A	0.26 (N)	N/A		No	BSL
	7440-70-2	Calcium	0.012	18.6	mg/L	PSEM-4	28-28		18.6	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	0.0008 (J)	0.001	mg/L	PS4-2004, PS5-2004, PS6-2004, RED COVE	7-28	0.002-0.00447	0.001	N/A	0.011 (N)*	N/A		No	BSL
	7440-48-4	Cobalt	0.00083	0.00083	mg/L	RCSW4	1-15	0.0002-0.0015	0.00083	N/A	0.073 (N)	N/A		No	BSL
	7440-50-8	Copper	0.001 (J)	0.0487	mg/L	SW-SHL-04	23-28	0.0015-0.00429	0.0487	N/A	0.15 (N)	N/A		No	BSL
	7439-89-6	Iron	0.214	29 (J2)	mg/L	RED COVE	28-28		29	N/A	1.1 (N)	N/A		**Yes**	ASL
	7439-92-1	Lead	0.0002 (J)	0.0004 (J)	mg/L	PS4-2004, PS6-2004	6-15	0.0002-0.005	0.0004	N/A	ND	N/A		**Yes**	NSL
	7439-95-4	Magnesium	0.0022	3.3	mg/L	PSEM-4	28-28		3.3	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.00781	0.53	mg/L	RED COVE	28-28		0.53	N/A	0.088 (N)	N/A		**Yes**	ASL
	7440-02-0	Nickel	0.0008	0.0442	mg/L	SW-SHL-04	18-28	0.006-0.00876	0.0442	N/A	0.073 (N)	N/A		No	BSL
	7440-09-7	Potassium	0.741	3	mg/L	PSEM-4	17-17		3	N/A	ND	N/A		No	NUT
	7440-22-4	Silver	0.000564	0.0036	mg/L	SW-SHL-09	2-28	0.0002-0.003	0.0036	N/A	99666693756E	N/A		No	BSL
	7440-23-5	Sodium	20	25.1	mg/L	PSEM-2	17-17		25.1	N/A	ND	N/A		No	NUT
	7440-66-6	Zinc	0.003 (J)	0.0581	mg/L	SW-SHL-04	14-28	0.008-0.02	0.0581	N/A	1.1 (N)	N/A		No	BSL
	319-84-6	Hexachlorocyclohexane, alpha-	0.000013	0.00007	mg/L	SW-SHL-04	13-19	0.0000275-0.0000275	0.00007	N/A	0.000011 (C)	N/A		**Yes**	ASL
	67-66-3	Chloroform	0.000996	0.00141	mg/L	SW-SHL-02	6-12	0.00083-0.00083	0.00141	N/A	0.00017 (C)	N/A		**Yes**	ASL
	75-09-2	Methylene chloride	0.00598	0.00892	mg/L	SW-SHL-12	12-12		0.00892	N/A	0.0043 (C)	N/A		**Yes**	ASL

Notes:

(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: J = estimated

(2) Screening concentration = maximum detected concentration.

(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.

(4) U.S. EPA Region IX Preliminary Remedial Goals (PRGs) for tap water, December 28, 2004.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)

(5) Rationale Codes
Selection Reason: ASL = above screening level.
NSL = no screening level available.
Deletion Reason: BSL = below screening level.
NUT = essential nutrient.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.
ND = not determined.

Additional Notes:
* PRG for hexavalent chromium.

TABLE 2-10

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish (filet)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Fish (filet)	7440-38-2	Arsenic	0.09	0.15	mg/kg-ww	PSP23F	2-10	0.04-0.16	0.15	N/A	0.0021 (C)	N/A		**Yes**	ASL
	7440-70-2	Calcium	82.8	627	mg/kg-ww	PSP18F2	10-10		627	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	0.19	0.24	mg/kg-ww	PSP06F	2-10	0.19-0.2	0.24	N/A	0.41 (N) [a]	N/A		No	BSL
	7440-48-4	Cobalt	0.11	0.11	mg/kg-ww	PSP18F2, PSP20F2	2-10	0.1-0.1	0.11	N/A	2.7 (N)	N/A		No	BSL
	7440-50-8	Copper	0.08	0.24	mg/kg-ww	PSP20F2	10-10		0.24	N/A	5.4 (N)	N/A		No	BSL
	7439-89-6	Iron	1.7	27	mg/kg-ww	PSP23F	10-10		27	N/A	41 (N)	N/A		No	BSL
	7439-95-4	Magnesium	252	344	mg/kg-ww	PSP17F	10-10		344	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.3	0.3	mg/kg-ww	PSP12F	1-10	0.28-0.3	0.3	N/A	2.7 (N)	N/A		No	BSL
	7439-97-6	Mercury	0.12	4	mg/kg-ww	PSP17F	9-10	0.03-0.03	4	N/A	0.041 (N) [b]	N/A		**Yes**	ASL
	7782-49-2	Selenium	0.11 (J)	0.2 (J)	mg/kg-ww	PSP17F2	8-10	0.1-0.18	0.2	N/A	0.68 (N)	N/A		No	BSL
	7440-23-5	Sodium	283	509	mg/kg-ww	PSP20F2	10-10		509	N/A	ND	N/A		No	NUT
	7440-62-2	Vanadium	0.79	0.79	mg/kg-ww	PSP17F	1-10	0.73-0.8	0.79	N/A	0.14 (N)	N/A		**Yes**	ASL
	7440-66-6	Zinc	3.4	6.1	mg/kg-ww	PSP22F	10-10		6.1	N/A	41 (N)	N/A		No	BSL
	72-55-9	DDE, p,p'-	0.015	0.031	mg/kg-ww	PSP17F2	2-10	0.0096-0.021	0.031	N/A	0.0093 (C)	N/A		**Yes**	ASL

Notes:

(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: J = estimated

(2) Screening concentration = maximum detected concentration.

(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.

(4) U.S. EPA Region III Risk-Based Concentrations (RBCs) for fish ingestion, April 7, 2005.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)

(5) Rationale Codes
Selection Reason: ASL = above screening level.
Deletion Reason: BSL = below screening level.
NUT = essential nutrient.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.
ND = not determined.

Additional Notes:
[a] RBC for hexavalent chromium.
[b] RBC for mercuric chloride.

TABLE 3-1

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Near-shore sediment	Aluminum	mg/kg	11800	20300 (NP)	90000	20300	mg/kg	C97.5	UCL < max
	Antimony	mg/kg	5.45	11.9 (NP)	49.2	11.9	mg/kg	C97.5	UCL < max
	Arsenic	mg/kg	81.0	158 (NP)	1300	158	mg/kg	C97.5	UCL < max
	Cadmium	mg/kg	13.1	48.6 (NP)	730	48.6	mg/kg	C97.5	UCL < max
	Chromium, total	mg/kg	5070	144 (NP)	52000	144	mg/kg	C99	UCL < max
	Copper	mg/kg	153	795 (NP)	13000	795	mg/kg	C97.5	UCL < max
	Iron	mg/kg	13900	19100 (NP)	42800	19100	mg/kg	C97.5	UCL < max
	Lead	mg/kg	227	382 (LN)	1760	227	mg/kg	mean	models specify mean
	Manganese	mg/kg	477	721 (NP)	2500	721	mg/kg	C97.5	UCL < max
	Mercury	mg/kg	24.8	94.4 (NP)	422	94.4	mg/kg	C99	UCL < max
	Selenium	mg/kg	4.86	9.76 (NP)	41.2	9.76	mg/kg	C97.5	UCL < max
	Thallium	mg/kg	8.87	26.4 (NP)	82.4	26.4	mg/kg	C99	UCL < max
	Vanadium	mg/kg	26.8	42.7 (NP)	140	42.7	mg/kg	C97.5	UCL < max
	Benz(a)anthracene	mg/kg	0.401	0.684 (NP)	3.4	0.684	mg/kg	C95	UCL < max
	Benzo(a)pyrene	mg/kg	0.420	0.729 (NP)	2.3	0.729	mg/kg	C95	UCL < max
	Benzo(b)fluoranthene	mg/kg	0.462	0.850 (NP)	5	0.850	mg/kg	C95	UCL < max
	Benzo(k)fluoranthene	mg/kg	0.361	0.839 (NP)	4.9	0.839	mg/kg	C97.5	UCL < max
	Chrysene	mg/kg	0.499	1.10 (NP)	5	1.10	mg/kg	C97.5	UCL < max
	Dibenz(ah)anthracene	mg/kg	0.242	0.263 (N)	0.73	0.263	mg/kg	St	UCL < max
	Indeno(1,2,3-cd)pyrene	mg/kg	0.384	0.641 (NP)	2.9	0.641	mg/kg	C95	UCL < max
	Naphthalene	mg/kg	1.10	3.84 (NP)	30	3.84	mg/kg	C97.5	UCL < max
	DDD, p,p'-	mg/kg	0.147	0.381 (NP)	2.5 (C)	0.381	mg/kg	C97.5	UCL < max

TABLE 3-1

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale

Notes:

(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).

Distribution: LN = lognormal.
N = normal.
NP = non-parametric.

(2) Data statistic used to represent the exposure point concentration.

C95 = 95% Chebyshev (Mean, StdDev) UCL.
C97.5 = 97.5% Chebyshev (Mean, StdDev) UCL.
C99 = 99% Chebyshev (Mean, StdDev) UCL.
H95 = 95% H-UCL.
St = Student's-t UCL.

TABLE 3-2

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

GROVE POND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Water	Arsenic	mg/L	0.0143	0.0767 (NP)	0.128	0.0767	mg/L	C99	UCL < max
	Barium	mg/L	1.21	6.99 (NP)	11.9	6.99	mg/L	C99	UCL < max
	Chromium, total	mg/L	0.0131	0.0740 (NP)	0.175	0.0740	mg/L	C99	UCL < max
	Iron	mg/L	39.2	69.2 (NP)	390	69.2	mg/L	HB	UCL < max
	Lead	mg/L	0.00275	0.0117 (NP)	0.027	0.00275	mg/L	mean	models specify mean
	Manganese	mg/L	0.206	0.301(NP)	1.04	0.301	mg/L	G95	UCL < max
	Zinc	mg/L	1.65	7.19 (NP)	9.11	7.19	mg/L	C99	UCL < max
	Bis(2-ethylhexyl) phthalate	mg/L	0.0153	0.0350 (NP)	0.051	0.0350	mg/L	C95	UCL < max

Notes:

(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).

Distribution: N = normal.
NP = non-parametric.

(2) Data statistic used to represent the exposure point concentration.

C95 = 95% Chebyshev (Mean, StdDev) UCL.
C99 = 99% Chebyshev (Mean, StdDev) UCL.
HB = Hall's bootstrap UCL.
max = maximum detected concentration.
St = Student's-t UCL.
G95= 95% Approximate Gamma UCL

TABLE 3-3

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

GROVE POND

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish (filet)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Fish (filet)	Cadmium	mg/kg	0.0282	0.0736 (NP)	0.151	0.0736	mg/kg	C95	UCL < max
	Chromium	mg/kg	0.227	0.278 (G)	0.488	0.278	mg/kg	Gap	UCL < max
	Lead	mg/kg	0.200	0.815 (NP)	0.859	0.200	mg/kg	mean	models specify mean
	Mercury	mg/kg	0.307	0.497 (G)	1.04	0.497	mg/kg	Gap	UCL < max
	Vanadium	mg/kg	0.0583	0.0715 (N)	0.164	0.0715	mg/kg	St	UCL < max
	PCBs, total	mg/kg	0.0464	0.0860 (NP)	0.15	0.0860	mg/kg	C95	UCL < max
	DDD, p,p'-	mg/kg	0.0114	0.0203 (NP)	0.03	0.0203	mg/kg	C95	UCL < max
	DDE, p,p'-	mg/kg	0.0214	0.0424 (NP)	0.07	0.0424	mg/kg	C95	UCL < max

Notes:

(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).
Distribution: G = gamma.
N = normal.
NP = non-parametric.

(2) Data statistic used to represent the exposure point concentration.
C95 = 95% Chebyshev (Mean, StdDev) UCL.
C99 = 99% Chebyshev (Mean, StdDev) UCL.
Gap = approximate gamma UCL.
St = Student's-t UCL.

TABLE 3-4

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Near-shore sediment	Aluminum	mg/kg	6810	9660 (NP)	27000	9660	mg/kg	C97.5	UCL < max
	Antimony	mg/kg	9.85	17.1 (NP)	30.7	17.1	mg/kg	C97.5	UCL < max
	Arsenic	mg/kg	435	930 (NP)	6800	930	mg/kg	C97.5	UCL < max
	Cadmium	mg/kg	8.28	15.3 (NP)	66 (J2)	15.3	mg/kg	C97.5	UCL < max
	Chromium, total	mg/kg	1360	12200 (LN)	37800	12200	mg/kg	H95	UCL < max
	Copper	mg/kg	97.5	297 (NP)	3450	297	mg/kg	C97.5	UCL < max
	Iron	mg/kg	47500	96300 (NP)	410000	96300	mg/kg	C97.5	UCL < max
	Lead	mg/kg	124	229 (NP)	1210	124	mg/kg	mean	models specify mean
	Manganese	mg/kg	1980	3020 (LN)	54800	3020	mg/kg	H95	UCL < max
	Mercury	mg/kg	13.8	34.7 (NP)	130	34.7	mg/kg	C99	UCL < max
	Thallium	mg/kg	11.9	13.4 (NP)	29.4	13.4	mg/kg	Mod-t	UCL < max
	Vanadium	mg/kg	20.9	35.6 (NP)	166	35.6	mg/kg	C97.5	UCL < max
	Benz(a)anthracene	mg/kg	0.647	3.65 (NP)	7.1	3.65	mg/kg	C99	UCL < max
	Benzo(a)pyrene	mg/kg	1.37	4.67 (G)	6.5	4.67	mg/kg	GAp	UCL < max
	Benzo(b)fluoranthene	mg/kg	1.76	3.90 (G)	11	3.90	mg/kg	GAp	UCL < max
	Benzo(k)fluoranthene	mg/kg	0.18	1.44 (G)	3.7	1.44	mg/kg	GAp	UCL < max
	Chrysene	mg/kg	0.812	4.28 (NP)	8.1	4.28	mg/kg	C99	UCL < max
	Dibenz(ah)anthracene	mg/kg	0.326	0.960 (G)	1.3	0.960	mg/kg	GAp	UCL < max
	Indeno(1,2,3-cd)pyrene	mg/kg	1.04	3.66 (G)	4.5	3.66	mg/kg	GAp	UCL < max

Notes:
(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).
Distribution: G = gamma.
LN = lognormal.

TABLE 3-4

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale

NP = non-parametric.

TABLE 3-4

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale

(2) Data statistic used to represent the exposure point concentration.

C97.5 = 97.5% Chebyshev (Mean, StdDev) UCL.

C99 = 99% Chebyshev (Mean, StdDev) UCL.

GAp = approximate gamma UCL.

H95 = 95% H-UCL.

Mod-t = modified Student's-t (adjusted for skewness)

TABLE 3-5

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Water	Arsenic	mg/L	0.0175	0.151 (NP)	0.38	0.151	mg/L	C99	UCL < max
	Iron	mg/L	1.52	5.97 (NP)	29 (J2)	5.97	mg/L	C95	UCL < max
	Lead	mg/L	0.000322	0.00379 (NP)	0.0004 (J)	0.000322	mg/L	mean	models specify mean
	Manganese	mg/L	0.0862	0.148 (LN)	0.53	0.148	mg/L	H95	UCL < max
	Hexachlorocyclohexane, alpha-	mg/L	0.0000331	0.0000524 (NP)	0.00007	0.0000524	mg/L	C95	UCL < max
	Chloroform	mg/L	0.000795	0.00131 (NP)	0.00141	0.00131	mg/L	C95	UCL < max
	Methylene chloride	mg/L	0.00766	0.00804 (N)	0.00892	0.00804	mg/L	St	UCL < max

Notes:

(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).

Distribution: LN = lognormal.
N = normal.
NP = non-parametric.

(2) Data statistic used to represent the exposure point concentration.

C95 = 95% Chebyshev (Mean, StdDev) UCL.
C99 = 99% Chebyshev (Mean, StdDev) UCL.
H95 = 95% H-UCL.
St = Student's-t UCL.

TABLE 3-6

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish (filet)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Fish (filet)	Arsenic	mg/kg	0.0498	0.0796 (G)	0.15	0.0796	mg/kg	Gap	UCL < max
	Mercury	mg/kg	1.14	2.59 (G)	4	2.59	mg/kg	Gap	UCL < max
	Vanadium	mg/kg	0.408	0.449 (NP)	0.79	0.449	mg/kg	Mt	UCL < max
	DDE, p,p'-	mg/kg	0.00967	0.0187 (NP)	0.031	0.0187	mg/kg	C95	UCL < max

Notes:
(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).
Distribution: G = gamma.
NP = non-parametric.
(2) Data statistic used to represent the exposure point concentration.
C95 = 95% Chebyshev (Mean, StdDev) UCL.
Gap = approximate gamma UCL.
Mt = Mod-t UCL (adjusted for skewness).

TABLE 3-7

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR	Ingestion rate	mg/day	100	EPA, 1995 (same as soil)	(CSD x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	100%	Professional Judgment	
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	
	ED	Exposure Duration	years	30	Residential recreational adult	
	CF	Conversion factor	kg/mg	1.00E-06	- -	
	BW	Body weight	kg	70	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004	
Dermal	DA_{event}	Absorbed dose per enent	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	(DA_{event} x EF x ED x EV x SA)/(BW x AT)
	ED	Exposure Duration	years	30	Residential recreational adult	
	EV	Event Frequency	events/day	1	Professional Judgment	where
	SA	Surface Area	cm^2	4,500	EPA 1997, 2004 (25% of total area)	DA_{event} (mg/cm^2-event) =
	BW	Body weight	kg	70	EPA, 1991	CSD x CF x AF x ABS_d
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	
	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	
	CF	Conversion factor	kg/mg	1.00E-06	- -	
	AF	Soil-Skin Adherence factor	mg/cm^2-event	1	MADEP (2002-B - sediment)	
	ABS_d	Dermal Absorption fraction	unitless	chemical specific	EPA 2004	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

MADEP 2002-B: Technical Update, Weighted Skin-Soil Adherence Factors.

TABLE 3-8

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C_{SW}	Chemical concentration in surface water	mg/L	EPC	Site Specific	CDI (mg/kg-day) =
	IR	Ingestion rate - wading	l/hour	0.01	EPA, 1995 (10ml/hr)	(CSW x IR x ET x EF x ED)/(BW x AT)
	ET	Exposure time	hours/day	4	Professional Judgment	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept	
	ED	Exposure duration	years	30	Residential recreational adult	
	BW	Body weight	kg	70	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004	
Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =
	EV	Event Frequency	events/day	1	Professional Judgment	(DA_{event} x EV x ED x EF x SA)/(BW x AT)
	ED	Exposure duration	years	30	Residential recreational adult	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept	
	SA	Surface area	cm^2	4,500	EPA 1997, 2004 (25% of total area)	For organics:
	BW	Body weight	kg	70	EPA, 1991	if t_{event} is less than or equal to t* then:
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	DA_{event} (mg/cm^2-event) =
	AT-N	Averaging time (Noncancer)	days	5,110	EPA, 1989	2 x FA x Kp x C_{SW} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)	if t_{event} is greater than t* then:
	Kp	Permeability coefficient	cm/hour	Chemical specific	- -	
	C_{SW}	Chemical concentration in surface water	mg/L	EPC	Site Specific	
	CF	Conversion factor	L/cm^3	0.001	Converts L to cm^3	
	tau_{event}	lag time per event	hours/event	Chemical specific	- -	For inorganics:
	t_{event}	Event Duration	hours/event	4	Professional Judgment	DA_{event} (mg/cm^2-event) =
	PI	Value of Pi	unitless	3.14	- -	Kp x C_{SW} x CF x t_{event}
	t*	Time to reach steady-state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	- -	

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995 http://www.epa.gov/region4/waste/ots/healtbul.htm

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

TABLE 3-9

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR_{fish}	Fish ingestion rate	g/meal-day	227	EPA, 2000 (8 oz portion for and adult)	(CS_{fish} x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	1	Professional Judgment	
	EF	Exposure Frequency	meal-days/year	41	1.05 meal/week (EPA, 1997-Table 10-63/ 90th percentile) for 9 temperate months of the year (39 weeks)	
	ED	Exposure Duration	years	30	Residential recreational adult	
	CF	Conversion factor	kg/g	1.00E-03	- -	
	BW	Body weight	kg	70	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989 (ED * 365)	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE 3-10
VALUES USED FOR DAILY INTAKE CALCULATIONS
RAGS D TABLE 4
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR	Ingestion rate	mg/day	200	EPA, 1995 (same as soil)	(CSD x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	100%	Professional Judgment	
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	
	ED	Exposure Duration	years	6	Used EPA 1991 value for residential child	
	CF	Conversion factor	kg/mg	1.00E-06	- -	
	BW	Body weight	kg	15	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004	
Dermal	DA_{event}	Absorbed dose per enent	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	(DA_{event} x EF x ED x EV x SA)/(BW x AT)
	ED	Exposure Duration	years	6	Used EPA 1991 value for residential child	
	EV	Event Frequency	events/day	1	Professional Judgment	where
	SA	Surface Area	cm^2	1,650	25% of the average (male and female) of 50^{th} percentile total body surface areas for age = 0 to 6 years (USEPA, 2004).	DA_{event} (mg/cm^2-event) =
	BW	Body weight	kg	15	EPA, 1991	CSD x CF x AF x ABS_d
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	
	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	
	CF	Conversion factor	kg/mg	1.00E-06	- -	
	AF	Soil-Skin Adherence factor	mg/cm^2-event	1	MADEP (2002-B - sediment)	
	ABS_d	Dermal Absorption fraction	unitless	chemical specific	EPA 2004	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

MADEP 2002-B: Technical Update, Weighted Skin-Soil Adherence Factors.

TABLE 3-11
VALUES USED FOR DAILY INTAKE CALCULATIONS
RAGS D TABLE 4
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CSW	Chemical concentration in surface water	mg/L	EPC	Site Specific	CDI (mg/kg-day) =
	IR	Ingestion rate - wading	l/hour	0.05	EPA, 1995 (50ml/hr)	(CSW x IR x ET x EF x ED)/(BW x AT)
	ET	Exposure Time	hours/day	4	Professional Judgment	
	EF	Exposure Frequency	days/year	65	Professional Judgment--3 days/week for May-Sept	
	ED	Exposure Duration	years	6	EPA, 1991	
	BW	Body weight	kg	15	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004	
Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =
	EV	Event Frequency	events/day	1	Professional Judgment	$(DA_{event}$ x EV x ED x EF x SA)/(BW x AT)
	ED	Exposure duration	years	6	Recreational child	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept	
	SA	Surface area	cm^2	1,650	EPA 1997, 2004 (25% of total area)	For organics:
	BW	Body weight	kg	15	EPA, 1991	if t_{event} is less than or equal to t* then:
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	DA_{event} (mg/cm^2-event) =
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	2 x FA x Kp x C_{SW} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)	
	Kp	Permeability coefficient	cm/hour	Chemical specific	- -	
	C_{SW}	Chemical concentration in surface water	mg/L	EPC	Site Specific	
	CF	Conversion factor	L/cm^3	0.001	Converts L to cm^3	
	tau_{event}	lag time per event	hours/event	Chemical specific	- -	For inorganics:
	t_{event}	Event Duration	hours/event	4	Professional Judgment	DA_{event} (mg/cm^2-event) =
	PI	Value of Pi	unitless	3.14	- -	Kp x C_{SW} x CF x t_{event}
	t*	Time to reach steady-state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	- -	

TABLE 3-11
VALUES USED FOR DAILY INTAKE CALCULATIONS
RAGS D TABLE 4
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995 http://www.epa.gov/region4/waste/ots/healtbul.htm

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

TABLE 3-12

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR_{fish}	Fish ingestion rate	g/meal-day	85	EPA, 2000 (3 oz portion for a child)	(CS_{fish} x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	1	Professional Judgment	
	EF	Exposure Frequency	meal-days/year	41	1.05 meal/week (EPA, 1997-Table 10-63/ 90th percentile) for 9 temperate months of the year (39 weeks)	
	ED	Exposure Duration	years	6	Residential recreational child	
	CF	Conversion factor	kg/g	1.00E-03	- -	
	BW	Body weight	kg	15	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE 3-13

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Subsistence
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR_{fish}	Fish ingestion rate	g/meal-day	227	EPA, 2000 (8 oz portion for and adult)	(CS_{fish} x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	1	Professional Judgment	
	EF	Exposure Frequency	meal-days/year	273	Assumed 7 meals/week for 9 temperate months of the year (39 weeks)	
	ED	Exposure Duration	years	30	EPA 1991 for Residential adult	
	CF	Conversion factor	kg/g	1.00E-03	- -	
	BW	Body weight	kg	70	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE 3-14

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Subsistence
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR_{fish}	Fish ingestion rate	g/meal-day	85	EPA, 2000 (3 oz portion for a childt)	(CS_{fish} x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	1	Professional Judgment	
	EF	Exposure Frequency	meal-days/year	273	Assumed 7 meals/week for 9 temperate months of the year (39 weeks)	
	ED	Exposure Duration	years	6	EPA 1991 for Residential child	
	CF	Conversion factor	kg/g	1.00E-03	- -	
	BW	Body weight	kg	15	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1996: EPA Soil Screening Guidance: Technical Background Document, May 1996.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE 3-15
DERMAL ABSORPTION FRACTION FROM SOIL
GROVE POND/PLOW SHOP POND

Compound	Dermal Absorption Fraction (ABS_d)	Notes
Aluminum	NQ- Addressed as an uncertainty	
Antimony	NQ- Addressed as an uncertainty	
Arsenic	0.03	
Barium	NQ- Addressed as an uncertainty	
Cadmium (in solid media)	0.001	
Cadmium (in water)	NA	
Chromium, total	NQ- Addressed as an uncertainty	
Copper	NQ- Addressed as an uncertainty	
Iron	NQ- Addressed as an uncertainty	
Lead	NQ- Addressed as an uncertainty	
Manganese (in sediment or water)	NQ- Addressed as an uncertainty	
Manganese (in food)	NQ- Addressed as an uncertainty	
Mercury	NQ- Addressed as an uncertainty	
Selenium	NQ- Addressed as an uncertainty	
Thallium	NQ- Addressed as an uncertainty	
Vanadium	NQ- Addressed as an uncertainty	
Zinc	NQ- Addressed as an uncertainty	
Chloroform	NQ- Addressed as an uncertainty	
Hexachlorocyclohexane, alpha-	0.04	
Methylene chloride	NQ- Addressed as an uncertainty	
Benz(a)anthracene	0.13	
Benzo(a)pyrene	0.13	
Benzo(b)fluoranthene	0.13	
Benzo(k)fluoranthene	0.13	
Chrysene	0.13	
Dibenz(ah)anthracene	0.13	
Indeno(1,2,3-cd)pyrene	0.13	
Naphthalene	0.13	
Bis(2-ethylhexyl) phthalate	0.1	
PCB 1254	0.14	
PCBs, total	0.14	a
DDD, p,p'-	0.03	a
DDE, p,p'-	0.03	

Note:
(1) Source: EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

(a) Surrogate value from DDT

TABLE 3-16
Dermal Worksheet
Intermediate Variables for Calculating DA(event)
GROVE POND/PLOW SHOP POND

Calculation of DA event for Surface Water

Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated	EPA 2004
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)
	Kp	Permeability coefficient	cm/hour	Chemical specific	- -
	C_{SW}	Chemical concentration in surface water	mg/L	EPC	Site Specific
	CF	Conversion factor	L/cm^3	0.001	Converts L to cm^3
	tau_{event}	lag time per event	hours/event	Chemical specific	- -
	t_{event}	Event Duration	hours/event	4	Professional Judgment
	PI	Value of Pi	unitless	3.14	- -
	t*	Time to reach steady-state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	- -

DA event for Organics

where t_{event} is less than or equal to t* then:

Equation 1

DA_{event} (mg/cm^2-event) =

2 x FA x Kp x C_{SW} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))

where t_{event} is greater than t* then:

Equation 2

$$\text{If } t_{event} > t^*, \text{ then: } DA_{event} = FA \times K_p \times C_w \left[\frac{t_{event}}{1 + B} + 2\ \tau_{event}\left(\frac{1 + 3\ B + 3\ B^2}{(1 + B)^2}\right)\right] \quad \text{x CF}$$

Organic COPCs in Surface water	t_{event}	t*	t*>t event	Equation to Use for DA event	**DA event**	Chem Specific Factor1	FA	Chem Specific Kp	Chem Specific Csw	CF	Factor2	tau_{event}	t_{event}	PI	B
Grove Pond															
Bis(2-ethylhexyl) phthalate	4	39.93	Yes	Equation 1	**1.97E-05**	2	1	2.50E-02	0.0350	0.001	6	16.64	4	3.142	0.2
Plow Shop Pond															
Hexachlorocyclohexane, alpha-	4	10.97	Yes	Equation 1	**6.81E-09**	2	1	1.10E-02	0.0000524	0.001	6	4.57	4	3.142	0.1
Chloroform	4	1.19	No	Equation 2	**4.45E-08**	2	1	6.80E-03	0.00131	0.001	6	0.5	4	3.142	0
Methylene chloride	4	0.76	No	Equation 2	**1.31E-07**	2	1	3.50E-03	0.00804	0.001	6	0.32	4	3.142	0

TABLE 3-16
Dermal Worksheet
Intermediate Variables for Calculating DA(event)
GROVE POND/PLOW SHOP POND

Calculation of DA event for Surface Water

DA event for Inorganics

DA_{event} (mg/cm^2-event) =

$Kp \times C_{SW} \times CF \times t_{event}$

Inrganic COPCs in Surface water	t_{event}				DA event		Source of Kp	Chem Specific Kp	Chem Specific Csw	CF
Grove Pond										
Arsenic	4				**3.07E-07**		default	0.001	0.0767	0.001
Barium	4				**2.80E-05**		default	0.001	6.99	0.001
Chromium, total	4				**5.92E-07**		experimental	0.002	0.0740	0.001
Iron	4				**2.77E-04**		default	0.001	69.2	0.001
Lead	4				**4.68E-08**		default	0.001	0.0117	0.001
Manganese	4				1.20E-06		default	0.001	0.301	0.001
Zinc	4				**1.73E-05**		experimental	6.00E-04	7.19	0.001
Plow Shop Pond										
Arsenic	4				**6.04E-07**		default	0.001	0.151	0.001
Iron	4				**2.39E-05**		default	0.001	5.97	0.001
Lead	4				**1.52E-09**		default	0.001	0.000379	0.001
Manganese	4				**5.92E-07**		default	0.001	0.148	0.001

TABLE 4-1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

RAGS D TABLE 5

GROVE POND / PLOW SHOP POND

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (ABS_{GI}) (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
Aluminum	Chronic	1.00E+00	mg/kg/day	1.00	1.00E+00	mg/kg-day	Central nervous system	100	PPRTV	3/15/2004
Antimony	Chronic	4.00E-04	mg/kg/day	0.15	6.00E-05	mg/kg-day	Blood	1000	IRIS	8/29/2005
Arsenic	Chronic	3.00E-04	mg/kg/day	1.00	3.00E-04	mg/kg-day	Skin	3	IRIS	8/29/2005
Barium	Chronic	2.00E-01	mg/kg/day	0.07	1.40E-02	mg/kg-day	Cardiovascular system, kidney	300	IRIS	8/29/2005
Cadmium (in solid media)	Chronic	1.00E-03	mg/kg/day	0.025	2.50E-05	mg/kg-day	Kidney	10	IRIS	8/29/2005
Cadmium (in water)	Chronic	5.00E-04	mg/kg/day	0.05	2.50E-05	mg/kg-day	Kidney	10	IRIS	8/29/2005
Chromium, total	Chronic	3.00E-03	mg/kg/day	0.013	3.90E-05	mg/kg-day	Gastrointestinal system	900	IRIS [a]	8/29/2005
Copper	Chronic	3.70E-02	mg/kg/day	1.00	3.70E-02	mg/kg-day	Gastrointestinal system	2	HEAST [b]	7/1/1997
Iron	Chronic	3.00E-01	mg/kg/day	1.00	3.00E-01	mg/kg-day	Gastrointestinal system	NQ	NCEA	12/28/2004
Lead	NA	NA	NA	1.00	NA	NA	Central nervous system	NA	IRIS	8/29/2005
Manganese (in sediment or water)	Chronic	2.40E-02	mg/kg/day	0.04	9.60E-04	mg/kg-day	Central nervous system	3	IRIS [c]	8/29/2005
Manganese (in food)	Chronic	1.40E-01	mg/kg/day	0.04	5.60E-03	mg/kg-day	Central nervous system	1	IRIS	8/29/2005
Mercury	Chronic	3.00E-04	mg/kg/day	0.07	2.10E-05	mg/kg-day	Immune system	1000	IRIS [d]	8/29/2005
Selenium	Chronic	5.00E-03	mg/kg/day	1.00	5.00E-03	mg/kg-day	entral nervous system, Liver, Ski	3	IRIS	8/29/2005
Thallium	Chronic	6.60E-05	mg/kg/day	1.00	6.60E-05	mg/kg-day	Liver	3000	PRG	12/28/2004
Vanadium	Chronic	1.00E-03	mg/kg/day	0.03	2.60E-05	mg/kg-day	Whole body	NQ	NCEA	12/28/2004
Zinc	Chronic	3.00E-01	mg/kg/day	1.00	3.00E-01	mg/kg-day	Blood	3	IRIS	8/29/2005
Chloroform	Chronic	1.00E-02	mg/kg/day	1.00	1.00E-02	mg/kg-day	Liver	100	IRIS	8/29/2005
Hexachlorocyclohexane, alpha-	Chronic	5.00E-04	mg/kg/day	1.00	5.00E-04	mg/kg-day	Kidney, Liver	NQ	NCEA	12/28/2004
Methylene chloride	Chronic	6.00E-02	mg/kg/day	1.00	6.00E-02	mg/kg-day	Liver	100	IRIS	8/29/2005
Benz(a)anthracene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Dibenz(ah)anthracene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Naphthalene	Chronic	2.00E-02	mg/kg/day	1.00	2.00E-02	mg/kg-day	Whole body	3000	IRIS	8/29/2005
Bis(2-ethylhexyl) phthalate	Chronic	2.00E-02	mg/kg/day	1.00	2.00E-02	mg/kg-day	Liver	1000	IRIS	8/29/2005
PCB 1254	Chronic	2.00E-05	mg/kg/day	1.00	2.00E-05	mg/kg-day	Immune system, Eyes, Skin	300	IRIS	8/29/2005
PCBs, total	Chronic	2.00E-05	mg/kg/day	1.00	2.00E-05	mg/kg-day	Immune system, Eyes, Skin	300	IRIS [f]	8/29/2005
DDD, p,p'-	Chronic	2.00E-03	mg/kg/day	1.00	2.00E-03	mg/kg-day	Liver	100	PPRTV	8/29/2005

TABLE 4-1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

RAGS D TABLE 5

GROVE POND / PLOW SHOP POND

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (ABS_{GI}) (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
DDE, p,p'-	Chronic	2.00E-03	mg/kg/day	1.00	2.00E-03	mg/kg-day	Liver	100	PPRTV [g]	8/29/2005

Notes:

(1) Source: EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

(2) From EPA 2004-- $RfD_{ABS} = RfD_o \times ABS_{GI}$

Additional Notes:

[a] Hexavalent chromium used as a surrogate.

[b] MCLG (1.3 mg/L) * 2 L/day / 70 kg.

[c] Assumes 50% dietary intake.

[d] Mercuric chloride used as a surrogate.

[f] PCB 1254 used as a surrogate.

[g] p,p'-DDD used as a surrogate.

Definitions: HEAST = Health Effects Assessment Summary Table.

IRIS = Integrated Risk Information System.

NA = not available.

NQ = not quantified

NCEA = National Center for Environmental Assessment.

PRG = USEPA Region 9 Preliminary Remediation Goals.

PPRTV = Provisional Peer Reviewed Toxicity Value.

TABLE 4-2

CANCER TOXICITY DATA -- ORAL/DERMAL

RAGS D TABLE 6

GROVE POND / PLOW SHOP POND

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (ABS_{GI}) (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description (3)	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s)
Aluminum	NC	NC	1.00	NC	NC	NC	NC	NC
Antimony	NC	NC	0.15	NC	NC	NC	NC	NC
Arsenic	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.00	1.50E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	8/29/2005
Barium	NC	NC	0.07	NC	NC	NC	NC	NC
Cadmium (in solid media)	NC	NC	0.025	NC	NC	NC	NC	NC
Cadmium (in water)	NC	NC	0.025	NC	NC	NC	NC	NC
Chromium, total	NC	NC	0.013	NC	NC	NC	NC	NC
Copper	NC	NC	1.00	NC	NC	NC	NC	NC
Iron	NC	NC	1.00	NC	NC	NC	NC	NC
Lead	NA	NA	1.00	NA	NA	B2	IRIS [a]	8/29/2005
Manganese (in sediment or water	NC	NC	0.04	NC	NC	NC	NC	NC
Manganese (in food)	NC	NC	0.04	NC	NC	NC	NC	NC
Mercury	NC	NC	0.07	NC	NC	NC	NC	NC
Selenium	NC	NC	1.00	NC	NC	NC	NC	NC
Thallium	NC	NC	1.00	NC	NC	NC	NC	NC
Vanadium	NC	NC	0.03	NC	NC	NC	NC	NC
Zinc	NC	NC	1.00	NC	NC	NC	NC	NC
Chloroform	NA	NA	1.00	NA	NA	B2	IRIS [c]	8/29/2005
Hexachlorocyclohexane, alpha-	6.30E+00	$(mg/kg\text{-}day)^{-1}$	1.00	6.30E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005
Methylene chloride	7.50E-03	$(mg/kg\text{-}day)^{-1}$	1.00	7.50E-03	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005
Benz(a)anthracene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Benzo(a)pyrene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005
Benzo(b)fluoranthene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Benzo(k)fluoranthene	7.30E-02	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-02	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Chrysene	7.30E-03	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-03	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Dibenz(ah)anthracene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E+00	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Indeno(1,2,3-cd)pyrene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Naphthalene	NC	NC	1.00	NC	NC	C	IRIS	8/29/2005
Bis(2-ethylhexyl) phthalate	1.40E-02	$(mg/kg\text{-}day)^{-1}$	1.00	1.40E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005
PCB 1254	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.00	2.00E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS [b]	8/29/2005
PCBs, total	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.00	2.00E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS [b]	8/29/2005
DDD, p,p'-	2.40E-01	$(mg/kg\text{-}day)^{-1}$	1.00	2.40E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005

APPENDIX A

Responses to EPA comments on Draft Human Health Risk Exposure Parameters
Comments received August 9, 2005

EPA COMMENTS:

1. **<u>Tables 1, 4 and un-numbered adolescent surface water table</u>**: There are some discrepancies between the equations in the tables and the dermal guidance. Specifically, DAevent should be mg/cm2-day rather than mg/m3-day. Fraction absorbed (FA) is missing. The conversion factor (CF, l/cm3) should be replaced by t event (hr/day). Please see box 3.2, 3.3, and 3.4 in the dermal guidance. Please provide an example calculation that can be checked by reference to the appendix in the guidance.

   RESPONSE: GF has updated all equations to match those included in the Final RAGS:E guidance. Typographical errors in the units were corrected. GF has included an example of the calculations performed in Appendix B of the human health risk assessment.

2. **<u>Tables 2, 5, and un-numbered adolescent sediment table</u>**: The dermal equation should be replaced by the dermal equation for soil contact from the dermal guidance (box 3.11 and 3.12). Please provide an example calculation that can be checked by reference to the appendix in the guidance.

   RESPONSE: GF has updated all equations to match those included in the Final RAGS:E guidance. GF has included an example of the calculations performed in Appendix B of the human health risk assessment.

3. **<u>Tables 2, 5, and un-numbered adolescent sediment table</u>**: Although the dermal equations will be replaced per item no. 2 above, the conversion factor in the dermal part of these tables should have been 1.00E-06 kg/mg, rather than 1.00E-06 l/cm3.

   RESPONSE: Typographical errors in the units have been corrected.

4. **<u>Tables 2 ,5, and un-numbered adolescent sediment table</u>**: Please provide a copy or URL for EPA, 1995 (Region IV bulletin) and a paragraph supporting this selection.

   RESPONSE: The URL for the cited values is:
   http://www.epa.gov/region4/waste/ots/healtbul.htm
   This reference has been included in the footnotes of the listed tables.

5. **<u>Tables 6</u>**: In the rationale column, change "Residential recreational adult" to "Residential recreational child"

   RESPONSE: GF has changed the term "Residential recreational adult" to "Residential recreational child" in Table 6.

6. **Tables 3 & 6**: In the RME Value column, round 40.95 to 41.

RESPONSE: GF has rounded the value for exposure frequency from 40.95 meals per year to 41 meals per year in these tables.

APPENDIX B

CALCULATION VERIFICATION

Exposure Point: Sediment
Receptor Population: Recreational
Receptor Age: Adult

CDI (mg/kg-day) =
(CSD x IR x FI x EF x ED x CF)/(BW x AT)

Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC
	IR	Ingestion rate	mg/day	100
	FI	Fraction ingested	unitless	100%
	EF	Exposure Frequency	days/year	65
	ED	Exposure Duration	years	30
	CF	Conversion factor	kg/mg	1.00E-06
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	10,950

DIMENSIONAL ANALYSIS

$$mg/kg\text{-}day = \frac{mg/\cancel{kg} * \frac{\cancel{mg}}{\cancel{day}} * 1 * \cancel{days}/\cancel{yr} * \cancel{yr} * \cancel{kg}/\cancel{mg}}{kg \cdot day}$$

$$mg/kg \cdot day = mg/kg \cdot day$$

INTAKE FACTOR EXAMPLE CALCULATION

$$CDI\,(mg/kg \cdot day) = \frac{C_{SD} * 100 * 1 * 65 * 30 * 1E-6}{70 * 25{,}550}$$

$$CDI\,(mg/kg \cdot day) = C_{SD} * 1.09E-7$$

RISK RESULT EXAMPLE CALCULATION

Asenic Grove Pond: EPC = 158 mg/kg, CSF = 1.5 $(mg/kg \cdot day)^{-1}$

$$CDI = 158\,mg/kg * 1.09E-7 = 1.72E-5\ mg/kg \cdot day$$

$$Risk = 1.72E-5\ mg/kg \cdot day * 1.5\,(mg/kg \cdot day)^{-1} = 2.58E-5$$

CALCULATION VERIFICATION

Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

CDI (mg/kg-day) =
(CSW x IR x ET x EF x ED)/(BW x AT)

Ingestion	C_{SW}	Chemical concentration in surface water	mg/L	EPC
	IR	Ingestion rate - wading	l/hour	0.01
	ET	Exposure time	hours/day	4
	EF	Exposure frequency	days/year	65
	ED	Exposure duration	years	30
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	10,950

DIMENSIONAL ANALYSIS

$$\frac{mg}{Kg\text{-}day} = \frac{mg/\cancel{L} \times \cancel{L}/\cancel{hour} \times \cancel{hours}/\cancel{day} \times \cancel{days}/\cancel{yr} \times \cancel{years}}{Kg \cdot day}$$

$$\frac{mg}{Kg\text{-}day} = mg/kg/day$$

INTAKE FACTOR EXAMPLE CALCULATION

$$CDI(mg/kg\text{-}day) = \frac{C_{sw} \times 0.01\ L/hr \times 4\ \frac{hrs}{day} \times 65\ \frac{days}{yera} \times 30\ years}{70 \times 25{,}550}$$

$$= C_{sw} \times 4.36E-5$$

RISK RESULT EXAMPLE CALCULATION

Arsenic, Grove Pond: EPC = 0.0767 mg/L, $CSF_o = 1.5(mg/kg\text{-}day)^{-1}$

CDI = 0.076 * 4.36E-5 = 3.31E-6

Risk = 3.31E-6 * 1.5 = 5.0E-6

CALCULATION VERIFICATION

Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Adult

CDI (mg/kg-day) =
(CSfish x IR x FI x EF x ED x CF)/(BW x AT)

Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC
	IR_{fish}	Fish ingestion rate	g/meal-day	227
	FI	Fraction ingested	unitless	1
	EF	Exposure Frequency	meal-days/year	41
	ED	Exposure Duration	years	30
	CF	Conversion factor	kg/g	1.00E-03
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	10,950

DIMENSIONAL ANALYSIS

$$mg/kg\cdot day = \frac{mg/\cancel{kg} * \frac{g}{meal\cdot \cancel{day}} * \frac{meal\cdot \cancel{day}}{\cancel{yr}} * years * \frac{kg}{g}}{kg\cdot day}$$

$$mg/kg\cdot day = mg/kg\cdot day$$

INTAKE FACTOR EXAMPLE CALCULATION

$$CDI(mg/kg\cdot day) = \frac{CS_{fish} * 227 * 1 * 41 * 30 * 1E\text{-}3}{70 * 25{,}550}$$

$$CDI(mg/kg\cdot day) = CS_{fish} * 1.56\,E^{-4}$$

RISK RESULT EXAMPLE CALCULATION

PCBs Grove Pond: EPC = 0.086 mg/kg, CSF = 2.0 $(mg/kg\cdot day)^{-1}$

$CDI = 0.086 * 1.56\,E^{-4} = 1.34\,E^{-5}\,(mg/kg\cdot day)$

$Risk = 1.34\,E^{-5}\ mg/kg\cdot day * 2.0\,(mg/kg\cdot day)^{-1}$

$Risk = 2.69\,E^{-5}$

CALCULATION VERIFICATION

Exposure Point: Sediment
Receptor Population: Recreational
Receptor Age: Adult

DAD (mg/kg-day) =
(DAevent x EF x ED x EV x SA)/(BW x AT)
where:
DAevent (mg/cm2-event) =
CSD x CF x AF x ABSd

	DAD	Dermally absorbed dose	mg/kg-day	Calculated
Dermal	DA_{event}	Absorbed dose per enent	mg/cm^2-event	Calculated
	EF	Exposure Frequency	days/year	65
	ED	Exposure Duration	years	30
	EV	Event Frequency	events/day	1
	SA	Surface Area	cm^2	4,500
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	10,950
	CSD	Chemical concentration in sediment	mg/kg	EPC
	CF	Conversion factor	kg/mg	1.00E-06
	AF	Soil-Skin Adherence factor	mg/cm^2-event	1
	ABS_d	Dermal Absorption fraction	unitless	chemical specific

DIMENSIONAL ANALYSIS

DAevent
DAevent (mg/cm2-event) = $\cancel{mg}$/$\cancel{kg}$ * $\cancel{kg}$/$\cancel{mg}$ * mg/cm2-event * ~~unitless~~ = mg/cm2-event

DAD
$$mg/kg\text{-}day = \frac{\frac{mg}{\cancel{cm^2}\text{-}\cancel{event}} * \cancel{days}/\cancel{year} * \cancel{years} * \frac{\cancel{events}}{\cancel{day}} * \cancel{cm^2}}{kg \cdot day} = \frac{mg}{kg \cdot day}$$

INTAKE FACTOR EXAMPLE CALCULATION

Arsenic, ABSd = 3E-2

DAevent = CSD * 1E-6 * 1 * 3E-2 = 3E-8 * CSD

$$DAD = DAevent * \frac{65 * 30 * 1 * 4500}{70 * 25,550} = DAevent * 4.91$$

RISK RESULT EXAMPLE CALCULATION

Arsenic, Grove Pond EPC = 158 mg/kg, CSF (mg/kg-day)$^{-1}$

DAD(mg/kg)day = 158 * 3E-8 * 4.91

DAD = 2.33 E-5

Risk = 2.33E-5 * 1.5 (mg/kg-day)$^{-1}$ = 3.49E-5

(note: Arsenic ABS_{GI} = 1.0)

CALCULATION VERIFCATION

Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

DAD (mg/kg-day) =
(DAevent x EV x ED x EF x SA)/(BW x AT)
Where
DA_{event} (mg/cm^2-event) =
See Three possible equations

Calculation of DA event for Surface Water

DA event for Organics

where t_{event} is less than or equal to t* then:

Equation 1
DA_{event} (mg/cm^2-event) =
2 x FA x Kp x C_{SW} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))

where t_{event} is greater than t* then:

Equation 2

$$If\ t_{event} > t^*,\ then:\ DA_{event} = FA \times K_p \times C_w \left[\frac{t_{event}}{1 + B} + 2\ \tau_{event} \left(\frac{1 + 3\ B + 3\ B^2}{(1 + B)^2} \right) \right] \quad \text{x CF}$$

DA event for Inorganics

DA_{event} (mg/cm^2-event) =
Kp x C_{SW} x CF x t_{event}

Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-~~day~~ event	Calculated
	FA	Fraction absorbed water	unitless	1
	Kp	Permeability coefficient	cm/hour	Chemical specific
	C_{SW}	Chemical concentration in surface water	mg/L	EPC
	CF	Conversion factor	L/cm^3	0.001
	tau_{event}	lag time per event	hours/event	Chemical specific
	t_{event}	Event Duration	hours/event	4
	PI	Value of Pi	unitless	3.14
	t*	Time to reach steady-state (hr) = 2.4 x tau_{even}	hours/event	Chemical specific

CALCULATION VERIFCATION

Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

DIMENSIONAL ANALYSIS

Eq1 - DAevent organic $mg/cm^2event = cm/hour * mg/L * L/cm^3(2) * \sqrt{hours/event * hours/event}$
$= mg/cm^2\text{-event}$

Eq2 - DAevent organic $mg/cm^2\text{-event} = cm/hr * mg/L * [hours/event + hours/event] * L/cm^3(2)$
$= mg/cm^2\text{-event}$

Eq3 DAevent inorganic $mg/cm^2\text{-event} = cm/hr * mg/L * L/cm^3 2 * hours/event$
$= mg/cm^2\text{-event}$

INTAKE FACTOR EXAMPLE CALCULATION

For DA event using organics equation 1

Example using Bis(2-ethylhexyl)phthalate at Grove Pond

$DAevent = 2 * 1 * 2.5E-2 * 0.035 * 0.001 * \sqrt{\frac{6 * 16.64 * 4}{3.1416}}$

$\boxed{DAevent = 1.97E-5}$

where FA = 1, CF = 0.001, Kp = 2.5E-2, tauevent = 16.64, Csw = 0.35, tevent = 4

For DA event organics equation 2

Example using Chloroform at Plow Shop Pond

$DAevent = 1 * 6.8E-3 * 0.00131 * \left(\frac{4}{1+0} + 2 * .5 \times \left(\frac{1+3\cdot0+3\cdot0^2}{(1+0)^2}\right)\right)$ $*.001$

FA = 1, B = 0
Kp = 6.8E-3, CF = 0.001
Cw = 0.00131
tevent = 4
tauevent = 0.5

$DAevent = 4.45E-8$

For DA event for inorganics

Example using arsenic in Grove Pond

$DAevent = 0.001 * 0.0767 * 0.001 * 4$

Kp = 0.001
Csw = 0.0767
CF = 0.001
tevent = 4

$DAevent = 3.1E-7$

CALCULATION VERIFCATION

Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

Verification of DAD

DAD (mg/kg-day) =
(DAevent x EV x ED x EF x SA)/(BW x AT)

Dermal	DAD	Dermally absorbed dose	mg/kg-day	Calculated
	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated
	EV	Event Frequency	events/day	1
	ED	Exposure duration	years	30
	EF	Exposure frequency	days/year	65
	SA	Surface area	cm^2	4,500
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	5,110

DIMENSIONAL ANALYSIS

$$DAD(mg/kg\text{-}day) = \frac{mg/\cancel{cm^2}\text{-}\cancel{event} \times \frac{\cancel{events}}{\cancel{day}} \times \cancel{years} \times \frac{\cancel{days}}{\cancel{year}} \times \cancel{cm^2}}{kg \cdot day}$$

$$= mg/kg \cdot day$$

INTAKE FACTOR EXAMPLE CALCULATION

$$DAD(mg/kg \cdot day) = DAevent \times \frac{1 \times 30 \times 65 \times 4500}{70 \times 25{,}550}$$

$$DAD(mg/kg \cdot day) = DA\,event \times 4.91$$

RISK RESULT EXAMPLE CALCULATION

Arsenic, Grove Pond, SW, See DAD for Arsenic from Page 2, $CSF_d = 1.5 (mg/kg\,day)^{-1}$

$$DAD(mg/kg \cdot day) = 3.1E\text{-}7 \times 4.91$$

$$DAD = 1.52\,E\text{-}6$$

$$Risk = 1.52E\text{-}6 \times 1.5 = 2.28\,E\text{-}6$$

APPENDIX C

TABLE C-1

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR	Ingestion rate	mg/day	100	EPA, 1995 (same as soil)	[(CSD x IR x FI x EF x ED x CF)/(BW x AT)]		
	FI	Fraction ingested	unitless	100%	Professional Judgment			
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept			
	ED	Exposure Duration	years	30	Residential recreational adult		Intake Factor-nc	
	CF	Conversion factor	kg/mg	1.00E-06	--		2.56E-07	X EPC
	BW	Body weight	kg	70	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		1.10E-07	X EPC
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989			
Dermal	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004		Intake Factor	
	DA_{event}	Absorbed dose per event	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =		
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	(DA_{event} x EF x ED x EV x SA)/(BW x AT)	Intake factor 2-NC	
	ED	Exposure Duration	years	30	Residential recreational adult		1.15E+01	X DA_{event}
	EV	Event Frequency	events/day	1	Professional Judgment	where	Intake factor 2-can	
	SA	Surface Area	cm^2	4,500	EPA 1997, 2004 (25% of total area)	DA_{event} (mg/cm^2-event) =	4.93E+00	X DA_{event}
	BW	Body weight	kg	70	EPA, 1991	CSD x CF x AF x ABS_d		
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		DA event	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989		Intake Factor 1-NC	
	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific		1.00E-06	X EPC X ABSd
	CF	Conversion factor	kg/mg	1.00E-06	--			
	AF	Soil-Skin Adherence factor	mg/cm^2-event	1	MADEP (2002-B - sediment)		1.00E-06	X EPC X ABSd
	ABS_d	Dermal Absorption fraction	unitless	chemical specific	EPA 2004			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03. March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment. EPA Region 4, Atlanta, GA, November 1995.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final.

MADEP 2002-B: Technical Update, Weighted Skin-Soil Adherence Factors.

TABLE C-2

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	C_{sw}	Chemical concentration in surface water	mg/L	EPC	Site Specific	CDI (mg/kg-day) =		
	IR	Ingestion rate - wading	l/hour	0.01	EPA, 1995 (10ml/hr)	(CSW x IR x ET x EF x ED)/(BW x AT)		
	ET	Exposure time	hours/day	4	Professional Judgment			
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept			
	ED	Exposure duration	years	30	Residential recreational adult		Intake Factor-nc	
	BW	Body weight	kg	70	EPA, 1991		1.02E-04	X EPC
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		Intake Factor-can	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989		4.36E-05	X EPC
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004		Intake Factor	
Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm²-event	Calculated	EPA 2004	DAD (mg/kg-day) =		
	EV	Event Frequency	events/day	1	Professional Judgment	(DA_{event} x EV x ED x EF x SA)/(BW x AT)		
	ED	Exposure duration	years	30	Residential recreational adult		Intake factor 2-NC	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept		2.43E+01	X DA_{event}
	SA	Surface area	cm²	4,320	EPA 1997, 2004 (25% of total area)	For organics:	Intake factor 2-can	
	BW	Body weight	kg	70	EPA, 1991	If t_{event} is less than or equal to t* then:	4.91E+00	X DA_{event}
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	DA_{event} (mg/cm²-event) =		
	AT-N	Averaging time (Noncancer)	days	3,110	EPA, 1989	2 x FA x Kp x C_{sw} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))	DA event	
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)	If t_{event} is greater than t* then:	See separate sheet	
	Kp	Permeability coefficient	cm/hour	Chemical specific	--			
	C_{sw}	Chemical concentration in surface water	mg/L	EPC	Site Specific			
	CF	Conversion factor	L/cm³	0.001	Converts L to cm³			
	tau_{event}	lag time per event	hours/event	Chemical specific	--	For inorganics:		
	t_{event}	Event Duration	hours/event	4	Professional Judgment	DA_{event} (mg/cm²-event) =		
	PI	Value of Pi	unitless	3.14	--	Kp x C_{sw} x CF x t_{event}		
	t*	Time to reach steady state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	--			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995 http://www.epa.gov/region4/waste/ots/healtbul.htm

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TABLE C-3

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR_{fish}	Fish ingestion rate	g/meal-day	227	EPA, 2000 (8 oz portion for and adult)	$(CS_{fish} \times IR \times FI \times EF \times ED \times CF)/(BW \times AT)$		
	FI	Fraction ingested	unitless	1	Professional Judgment			
	EF	Exposure Frequency	meal-days/year	41	1.05 meal/week (EPA, 1997-Table 10-63/ 90th percentile) for 9 temperate months of the year (39 weeks)			
	ED	Exposure Duration	years	30	Residential recreational adult		Intake Factor-nc	
	CF	Conversion factor	kg/g	1.00E-03	--		3.04E-04	X EPC
	BW	Body weight	kg	70	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		1.30E-04	X EPC
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989 (ED * 365)			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consumption Limits, Third Edition.

TABLE C-4

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Terms
Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR	Ingestion rate	mg/day	200	EPA, 1995 (same as soil)	(CSD x IR x FI x EF x ED x CF)/(BW x AT)		
	FI	Fraction ingested	unitless	100%	Professional Judgment			
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept			
	ED	Exposure Duration	years	6	Used EPA 1991 value for residential child		Intake Factor-nc	
	CF	Conversion factor	kg/mg	1.00E-06	- -		2.35E-06	X EPC
	BW	Body weight	kg	15	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		2.05E-07	X EPC
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989			
Dermal	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004		Intake Factor	
	DA_{event}	Absorbed dose per event	mg/cm²-event	Calculated	EPA 2004	DAD (mg/kg-day) =		
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	(DA_{event} x EF x ED x EV x SA)/(BW x AT)	Intake factor 2-NC	
	ED	Exposure Duration	years	6	Used EPA 1991 value for residential child		1.07E+01	X DA_{event}
	EV	Event Frequency	events/day	1	Professional Judgment	where	Intake factor 2-can	
	SA	Surface Area	cm²	1,850	25% of the average (male and female) of 50th percentile total body surface areas for age = 0 to 6 years (USEPA, 2004)	DA_{event} (mg/cm²-event) =	1.85E+00	X DA_{event}
	BW	Body weight	kg	15	EPA, 1991	CSD x CF x AF x ABS_d		
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		DA event	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989		Intake Factor 1-NC	
	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific		1.00E-06	X EPC X ABSd
	CF	Conversion factor	kg/mg	1.00E-06	- -			
	AF	Soil-Skin Adherence factor	mg/cm²-event	1	MADEP (2002-B - sediment)		1.00E-06	X EPC X ABSd
	ABS_d	Dermal Absorption fraction	unitless	chemical specific	EPA 2004			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund: Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment. EPA Region 4, Atlanta, GA, November 1995.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final.

MADEP 2002-B: Technical Update, Weighted Skin-Soil Adherence Factors.

TABLE C-5

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CSW	Chemical concentration in surface water	mg/L	EPC	Site Specific	CDI (mg/kg-day) =		
	IR	Ingestion rate - wading	l/hour	0.05	EPA, 1995 (child/hr)	(CSW x IR x ET x EF x ED)/(BW x AT)		
	ET	Exposure Time	hours/day	4	Professional Judgment			
	EF	Exposure Frequency	days/year	65	Professional Judgment=3 days/week for May-Sept			
	ED	Exposure Duration	years	6	EPA, 1991		Intake Factor-nc	
	BW	Body weight	kg	15	EPA, 1991		2.36E-03	X EPC
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		Intake Factor-car	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989		2.03E-04	X EPC
Dermal	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004		Intake Factor	
	DA_{event}	Absorbed dose per unit body surface/day	mg/cm²-event	Calculated	EPA 2004	DAD (mg/kg-day) =		
	EV	Event Frequency	events/day	1	Professional Judgment	$(DA_{event}$ x EV x ED x EF x SA)/(BW x AT)		
	ED	Exposure duration	years	6	Recreational child		Intake factor 2-NE	
	EF	Exposure frequency	days/year	65	Professional Judgment -3 days/week for May-Sept		1.96E+01	X DA_{event}
	SA	Surface area	cm²	1,650	EPA 1997, 2004 (25% of total area)	For organics:	Intake factor 2-car	
	BW	Body weight	kg	15	EPA, 1991	If t_{event} is less than or equal to t* then:	1.68E+00	X DA_{event}
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	DA_{event} (mg/cm²-event) =		
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	2 x FA x Kp x C_{sw} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))	DA event	
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)		See separate Sheet	
	Kp	Permeability coefficient	cm/hour	Chemical specific	---			
	C_{sw}	Chemical concentration in surface water	mg/L	EPC	Site Specific			
	CF	Conversion factor	L/cm³	0.001	Converts L to cm³			
	tau_{event}	lag time per event	hours/event	Chemical specific	---	For inorganics:		
	t_{event}	Event Duration	hours/event	4	Professional Judgment	DA_{event} (mg/cm²-event) =		
	PI	Value of PI	unitless	3.14	---	Kp x C_{sw} x CF x t_{event}		
	t*	Time to reach steady state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	---			

Notes:

EPA, 1989. Risk Assessment Guidance for Superfund, Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991. EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03. March 25, 1991.

EPA, 1995. Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment. EPA Region 4, Atlanta, GA. November 1995 http://www.epa.gov/region4/waste/ots/healtbul.htm

EPA, 1997. EPA Exposure Factors Handbook, 1997.

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TABLE C-6

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR_{fish}	Fish ingestion rate	g/meal-day	85	EPA, 2000 (3 oz portion for a child)	$(CS_{fish} \times IR \times FI \times EF \times ED \times CF)/(BW \times AT)$		
	FI	Fraction ingested	unitless	1	Professional Judgment			
	EF	Exposure Frequency	meal-days/year	41	1.05 meal/week (EPA, 1997-Table 10-63/ 90th percentile) for 9 temperate months of the year (39 weeks)			
	ED	Exposure Duration	years	6	Residential recreational child		Intake Factor-nc	
	CF	Conversion factor	kg/g	1.00E-03	--		6.37E-04	X EPC
	BW	Body weight	kg	15	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		5.46E-05	X EPC
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consumption Limits. Third Edition.

TABLE C-7

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Subsistence
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR_{fish}	Fish ingestion rate	g/meal-day	227	EPA, 2000 (8 oz portion for and adult)	$(CS_{fish} \times IR \times FI \times EF \times ED \times CF)/(BW \times AT)$		
	FI	Fraction ingested	unitless	1	Professional Judgment			
	EF	Exposure Frequency	meal-days/year	273	Assumed 7 meals/week for 9 temperate months of the year (39 weeks)			
	ED	Exposure Duration	years	30	EPA 1991 for Residential adult		Intake Factor-nc	
	CF	Conversion factor	kg/g	1.00E-03	--		2.43E-03	X EPC
	BW	Body weight	kg	70	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		1.04E-03	X EPC
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03. March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consumption Limits. Third Edition.

TABLE C-8

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Subsistence
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR_{fish}	Fish ingestion rate	g/meal-day	85	EPA, 2000 (3 oz portion for a child)	$(CS_{fish} \times IR \times FI \times EF \times ED \times CF)/(BW \times AT)$		
	FI	Fraction ingested	unitless	1	Professional Judgement			
	EF	Exposure Frequency	meal-days/year	273	Assumed 7 meals/week for 9 temperate months of the year (39 weeks)			
	ED	Exposure Duration	years	6	EPA 1991 for Residential child		Intake Factor-nc	
	CF	Conversion factor	kg/g	1.00E-03	--		8.48E-04	X EPC
	BW	Body weight	kg	15	EPA, 1991		Intake Factor-car	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		3.63E-04	X EPC
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1996: EPA Soil Screening Guidance: Technical Background Document. May 1996.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consumption Limits, Third Edition.

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	20300	mg/kg	1.10E-07			2.23E-03		NC	NC	
	Antimony	11.9	mg/kg	1.10E-07			1.30E-06		NC	NC	
	Arsenic	158	mg/kg	1.10E-07			1.73E-05		1.50E+00	(mg/kg-day)-1	2.60E-05
	Barium	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Cadmium (in solid media)	48.6	mg/kg	1.10E-07			5.33E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	144	mg/kg	1.10E-07			1.58E-05		NC	NC	
	Copper	795	mg/kg	1.10E-07			8.72E-05		NC	NC	
	Iron	19100	mg/kg	1.10E-07			2.09E-03		NC	NC	
	Lead	382	mg/kg	1.10E-07			4.19E-05		NA	NA	
	Manganese (in sediment or water)	721	mg/kg	1.10E-07			7.90E-05		NC	NC	
	Manganese (in food)	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Mercury	94.4	mg/kg	1.10E-07			1.03E-05		NC	NC	
	Selenium	9.76	mg/kg	1.10E-07			1.07E-06		NC	NC	
	Thallium	26.4	mg/kg	1.10E-07			2.89E-06		NC	NC	
	Vanadium	42.7	mg/kg	1.10E-07			4.68E-06		NC	NC	
	Zinc	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.10E-07			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.10E-07			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.10E-07			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0.684	mg/kg	1.10E-07			7.50E-08		7.30E-01	(mg/kg-day)-1	5.47E-08
	Benzo(a)pyrene	0.729	mg/kg	1.10E-07			7.99E-08		7.30E+00	(mg/kg-day)-1	5.83E-07
	Benzo(b)fluoranthene	0.85	mg/kg	1.10E-07			9.32E-08		7.30E-01	(mg/kg-day)-1	6.80E-08
	Benzo(k)fluoranthene	0.839	mg/kg	1.10E-07			9.20E-08		7.30E-02	(mg/kg-day)-1	6.71E-09
	Chrysene	1.1	mg/kg	1.10E-07			1.21E-07		7.30E-03	(mg/kg-day)-1	8.80E-10
	Dibenz(ah)anthracene	0.263	mg/kg	1.10E-07			2.88E-08		7.30E+00	(mg/kg-day)-1	2.10E-07
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	1.10E-07			7.03E-08		7.30E-01	(mg/kg-day)-1	5.13E-08
	Naphthalene	3.84	mg/kg	1.10E-07			4.21E-07		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.10E-07			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.10E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.10E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0.381	mg/kg	1.10E-07			4.18E-08		2.40E-01	(mg/kg-day)-1	1.00E-08
	DDE, p,p'-	0	mg/kg	1.10E-07			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											2.70E-05

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	20300	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Antimony	11.9	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Arsenic	158	mg/kg	4.93E+00	1.00E-06	3.00E-02	2.34E-05		1.50E+00	(mg/kg-day)-1	3.51E-05
	Barium	0	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Cadmium (in solid media)	49.6	mg/kg	4.93E+00	1.00E-06	1.00E-03	2.40E-07		NC	NC	
	Cadmium (in water)					NA			NC	NC	
	Chromium, total	144	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Copper	795	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Iron	19100	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Lead	382	mg/kg	4.93E+00	1.00E-06		#VALUE!		NA	NA	
	Manganese (in sediment or water)	721	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Manganese (in food)	0	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Mercury	94.4	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Selenium	9.76	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Thallium	26.4	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Vanadium	42.7	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Zinc	0	mg/kg	4.93E+00	1.00E-06		#VALUE!		NC	NC	
	Chloroform	0	mg/kg	4.93E+00	1.00E-06		#VALUE!		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	4.93E+00	1.00E-06	4.00E-02	0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/kg	4.93E+00	1.00E-06		#VALUE!		7.50E-03	(mg/kg-day)-1	
	Benz(a)anthracene	0.684	mg/kg	4.93E+00	1.00E-06	1.30E-01	4.39E-07		7.30E-01	(mg/kg-day)-1	3.20E-07
	Benzo(a)pyrene	0.729	mg/kg	4.93E+00	1.00E-06	1.30E-01	4.68E-07		7.30E+00	(mg/kg-day)-1	3.41E-06
	Benzo(b)fluoranthene	0.85	mg/kg	4.93E+00	1.00E-06	1.30E-01	5.45E-07		7.30E-01	(mg/kg-day)-1	3.98E-07
	Benzo(k)fluoranthene	0.839	mg/kg	4.93E+00	1.00E-06	1.30E-01	5.38E-07		7.30E-02	(mg/kg-day)-1	3.93E-08
	Chrysene	1.1	mg/kg	4.93E+00	1.00E-06	1.30E-01	7.05E-07		7.30E-03	(mg/kg-day)-1	5.15E-09
	Dibenz(ah)anthracene	0.263	mg/kg	4.93E+00	1.00E-06	1.30E-01	1.69E-07		7.30E+00	(mg/kg-day)-1	1.23E-06
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	4.93E+00	1.00E-06	1.30E-01	4.11E-07		7.30E-01	(mg/kg-day)-1	3.00E-07
	Naphthalene	3.84	mg/kg	4.93E+00	1.00E-06	1.30E-01	2.46E-06		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	4.93E+00	1.00E-06	1.00E-01	0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	4.93E+00	1.00E-06	1.40E-01	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	4.93E+00	1.00E-06	1.40E-01	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0.381	mg/kg	4.93E+00	1.00E-06	3.00E-02	5.64E-08		2.40E-01	(mg/kg-day)-1	1.35E-08
	DDE, p,p'-	0	mg/kg	4.93E+00	1.00E-06	3.00E-02	0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											4.08E-05
Grand Total											6.78E-05

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	20300	mg/kg	2.56E-07			5.19E-03	mg/kg-day	1.00E+00	mg/kg/day	5.19E-03
	Antimony	11.9	mg/kg	2.56E-07			3.04E-06	mg/kg-day	4.00E-04	mg/kg/day	7.61E-03
	Arsenic	158	mg/kg	2.56E-07			4.04E-05	mg/kg-day	3.00E-04	mg/kg/day	1.35E-01
	Barium	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	48.6	mg/kg	2.56E-07			1.24E-05	mg/kg-day	1.00E-03	mg/kg/day	1.24E-02
	Cadmium (in water)			2.56E-07			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	144	mg/kg	2.56E-07			3.68E-05	mg/kg-day	3.00E-03	mg/kg/day	1.23E-02
	Copper	795	mg/kg	2.56E-07			2.03E-04	mg/kg-day	3.70E-02	mg/kg/day	5.50E-03
	Iron	19100	mg/kg	2.56E-07			4.89E-03	mg/kg-day	3.00E-01	mg/kg/day	1.63E-02
	Lead	382	mg/kg	2.56E-07			9.77E-05	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	721	mg/kg	2.56E-07			1.84E-04	mg/kg-day	2.40E-02	mg/kg/day	7.68E-03
	Manganese (in food)	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	94.4	mg/kg	2.56E-07			2.41E-05	mg/kg-day	3.00E-04	mg/kg/day	8.05E-02
	Selenium	9.76	mg/kg	2.56E-07			2.50E-06	mg/kg-day	5.00E-03	mg/kg/day	4.99E-04
	Thallium	26.4	mg/kg	2.56E-07			6.75E-06	mg/kg-day	6.60E-05	mg/kg/day	1.02E-01
	Vanadium	42.7	mg/kg	2.56E-07			1.09E-05	mg/kg-day	1.00E-03	mg/kg/day	1.09E-02
	Zinc	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0.684	mg/kg	2.56E-07			1.75E-07	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0.729	mg/kg	2.56E-07			1.86E-07	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0.85	mg/kg	2.56E-07			2.17E-07	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0.839	mg/kg	2.56E-07			2.15E-07	mg/kg-day	NA	NA	
	Chrysene	1.1	mg/kg	2.56E-07			2.81E-07	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.263	mg/kg	2.56E-07			6.73E-08	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	2.56E-07			1.64E-07	mg/kg-day	NA	NA	
	Naphthalene	3.84	mg/kg	2.56E-07			9.82E-07	mg/kg-day	2.00E-02	mg/kg/day	4.91E-05
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0.381	mg/kg	2.56E-07			9.75E-08	mg/kg-day	2.00E-03	mg/kg/day	4.87E-05
	DDE, p,p'-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											3.96E-01

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	20300	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	11.9	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	158	mg/kg	1.15E+01	1.00E-06	3.00E-02	5.46E-05	mg/kg-day	3.00E-04	mg/kg-day	1.82E-01
	Barium	0	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	1.40E-02	mg/kg-day	
	Cadmium (in solid media)	48.6	mg/kg	1.15E+01	1.00E-06	1.00E-03	5.59E-07	mg/kg-day	2.50E-05	mg/kg-day	2.24E-02
	Cadmium (in water)			1.15E+01	1.00E-06	NA	#VALUE!	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	144	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	3.90E-05	mg/kg-day	
	Copper	795	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	19130	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Lead	382	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	721	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	9.60E-04	mg/kg-day	
	Manganese (in food)	0	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	94.4	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	9.76	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	26.4	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	42.7	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Chloroform	0	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.15E+01	1.00E-06	4.00E-02	0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	0.00E+00
	Methylene chloride	0	mg/kg	1.15E+01	1.00E-06	______	#VALUE!	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	0.684	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.02E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0.729	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.09E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0.85	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.27E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0.839	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.26E-06	mg/kg-day	NA	NA	
	Chrysene	1.1	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.65E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.263	mg/kg	1.15E+01	1.00E-06	1.30E-01	3.94E-07	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	1.15E+01	1.00E-06	1.30E-01	9.59E-07	mg/kg-day	NA	NA	
	Naphthalene	3.84	mg/kg	1.15E+01	1.00E-06	1.30E-01	5.75E-06	mg/kg-day	2.00E-02	mg/kg-day	2.87E-04
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.15E+01	1.00E-06	1.00E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/kg	1.15E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/kg	1.15E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0.381	mg/kg	1.15E+01	1.00E-06	3.00E-02	1.32E-07	mg/kg-day	2.00E-03	mg/kg-day	6.58E-05
	DDE, p,p'-	0	mg/kg	1.15E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											2.05E-01
Grand Total											6.01E-01

Target organ across all exposure pathways: Central nervous system =	1.34E-02
Target organ across all exposure pathways: Blood =	7.61E-03
Target organ across all exposure pathways: Skin =	3.17E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	3.48E-02
Target organ across all exposure pathways: Gastrointestinal System =	3.41E-02
Target organ across all exposure pathways: Immune system =	8.05E-02
Target organ across all exposure pathways: Liver =	1.02E-01

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
						Target organ across all exposure pathways: Whole body/growth =					1.13E-02

TABLE C-10 Grove Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Antimony	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Arsenic	0.0767	mg/L	4.39E-05			3.36E-06		1.50E+00	(mg/kg-day)-1	5.05E-06
	Barium	6.99	mg/L	4.39E-05			3.07E-04		NC	NC	
	Cadmium (in solid media)	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Cadmium (in water)		mg/L						NC	NC	
	Chromium, total	0.074	mg/L	4.39E-05			3.25E-06		NC	NC	
	Copper	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Iron	69.2	mg/L	4.39E-05			3.03E-03		NC	NC	
	Lead	0.0117	mg/L	4.39E-05			5.13E-07		NA	NA	
	Manganese (in sediment or water)	0.301	mg/L	4.39E-05			1.32E- 05		NC	NC	
	Manganese (in food)	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Mercury	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Selenium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Thallium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Vanadium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Zinc	7.19	mg/L	4.39E-05			3.15E-04		NC	NC	
	Chloroform	0	mg/L	4.39E-05			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/L	4.39E-05			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/L	4.39E-05			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	4.39E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	4.39E-05			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	4.39E-05			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	4.39E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	4.39E-05			1.53E-06		1.40E-02	(mg/kg-day)-1	2.15E-08
	PCB 1254	0	mg/L	4.39E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	4.39E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	4.39E-05			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	4.39E-05			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											5.07E-06

TABLE C-10 Grove Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
				Intake Factor	DA event		Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Antimony	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Arsenic	0.0767	mg/L	4.91E+00	3.07E-07		1.51E-06		1.50E+00	(mg/kg-day)-1	2.26E-06
	Barium	6.99	mg/L	4.91E+00	2.80E-05		1.37E-04		NC	NC	
	Cadmium (in solid media)	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in water)				0.00E+00		0.00E+00		NC	NC	
	Chromium, total	0.074	mg/L	4.91E+00	5.92E-07		2.90E-06		NC	NC	
	Copper	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Iron	69.2	mg/L	4.91E+00	2.77E-04		1.36E-03		NC	NC	
	Lead	0.0117	mg/L	4.91E+00	4.68E-08		2.30E-07		NA	NA	
	Manganese (in sediment or water)	0.301	mg/L	4.91E+00	1.20E-06		5-89E-06		NC	NC	
	Manganese (in food)	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Mercury	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Selenium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Thallium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Vanadium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Zinc	7.19	mg/L	4.91E+00	1.73E-05		8.47E-05		NC	NC	
	Chloroform	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	4.91E+00	1.97E-05		9.68E-05		1.40E-02	(mg/kg-day)-1	1.36E-06
	PCB 1254	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											3.61E-06
Grand Total											8.68E-06

TABLE C-10 Grove Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0767	mg/L	1.02E-04			7.85E-06	mg/kg-day	3.00E-04	mg/kg/day	2.62E-02
	Barium	6.99	mg/L	1.02E-04			7.15E-04	mg/kg-day	2.00E-01	mg/kg/day	3.58E-03
	Cadmium (in solid media)	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)		mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.074	mg/L	1.02E-04			7.57E-06	mg/kg-day	3.00E-03	mg/kg/day	2.52E-03
	Copper	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	69.2	mg/L	1.02E-04			7.08E-03	mg/kg-day	3.00E-01	mg/kg/day	2.36E-02
	Lead	0.0117	mg/L	1.02E-04			1.20E-06	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.301	mg/L	1.02E-04			3.10E-05	mg/kg-day	2.40E-02	mg/kg/day	1.29E-03
	Manganese (in food)	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Selenium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Zinc	7.19	mg/L	1.02E-04			7.36E-04	mg/kg-day	3.00E-01	mg/kg/day	2.45E-03
	Chloroform	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	1.02E-04			3.58E-06	mg/kg-day	2.00E-02	mg/kg/day	1.79E-04
	PCB 1254	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											5.77E-02

TABLE C-10 Grove Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event		Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	0.0767	mg/L	2.45E+01	3.07E-07		7.53E-06	mg/kg-day	3.00E-04	mg/kg-day	2.51E-02
	Barium	6.99	mg/L	2.45E+01	2.80E-05		6.86E-04	mg/kg-day	1.40E-02	mg/kg-day	4.90E-02
	Cadmium (in solid media)	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	0.00E+00
	Cadmium (in water)			2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	0.074	mg/L	2.45E+01	5.92E-07		1.45E-05	mg/kg-day	3.90E-05	mg/kg-day	3.72E-01
	Copper	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	69.2	mg/L	2.45E+01	2.77E-04		6.79E-03	mg/kg-day	3.00E-01	mg/kg-day	2.26E-02
	Lead	0.0117	mg/L	2.45E+01	4.68E-08		1.15E-06	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.301	mg/L	2.45E+01	1.20E06		2.94E05	mg/kg-day	9.60E04	mg/kg-day	3.06E02
	Manganese (in food)	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	7.19	mg/L	2.45E+01	1.73E-05		4.23E-04	mg/kg-day	3.00E-01	mg/kg-day	1.41E-03
	Chloroform	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	
	Methylene chloride	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	2.45E+01	1.97E-05		4.84E-04	mg/kg-day	2.00E-02	mg/kg-day	2.42E-02
	PCB 1254	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											5.31E-01
Grand Total											5.88E-01

Target organ across all exposure pathways: Central nervous system =	3.2E-02
Target organ across all exposure pathways: Blood =	3.86E-03
Target organ across all exposure pathways: Skin =	5.12E-02
Target organ across all exposure pathways: Cardiovascular system =	5.26E-02
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	4.21E-01
Target organ across all exposure pathways: Immune system =	0.00E+00
Target organ across all exposure pathways: Liver =	2.44E-02
Target organ across all exposure pathways: Whole body/growth =	0.00E+00

TABLE C-11 Grove Pond
Recreational Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Antimony	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Arsenic	0	mg/kg	1.56E-04			0.00E+00		1.50E+00	(mg/kg-day)-1	0.00E+00
	Barium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0.0736	mg/kg	1.56E-04			1.15E-05		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0.278	mg/kg	1.56E-04			4.34E-05		NC	NC	
	Copper	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Iron	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Lead	0.815	mg/kg	1.56E-04			1.27E-04		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Mercury	0.497	mg/kg	1.56E-04			7.76E-05		NC	NC	
	Selenium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Thallium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Vanadium	0.0715	mg/kg	1.56E-04			1.12E-05		NC	NC	
	Zinc	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.56E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.56E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.56E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	1.56E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	1.56E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	1.56E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	1.56E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.56E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.56E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0.086	mg/kg	1.56E-04			1.34E-05		2.00E+00	(mg/kg-day)-1	2.69E-05
	DDD, p,p'-	0.0203	mg/kg	1.56E-04			3.17E-06		2.40E-01	(mg/kg-day)-1	7.61E-07
	DDE, p,p'-	0.0424	mg/kg	1.56E-04			6.62E-06		3.40E-01	(mg/kg-day)-1	2.25E-06
Total											2.99E-05
Grand Total											2.99E-05

TABLE C-11 Grove Pond
Recreational Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Barium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0.0736	mg/kg	3.64E-04			2.68E-05	mg/kg-day	1.00E-03	mg/kg/day	2.68E-02
	Cadmium (in water)			3.64E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.278	mg/kg	3.64E-04			1.01E-04	mg/kg-day	3.00E-03	mg/kg/day	3.38E-02
	Copper	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0.815	mg/kg	3.64E-04			2.97E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0.497	mg/kg	3.64E-04			1.81E-04	mg/kg-day	3.00E-04	mg/kg/day	6.03E-01
	Selenium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.0715	mg/kg	3.64E-04			2.60E-05	mg/kg-day	1.00E-03	mg/kg/day	2.60E-02
	Zinc	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0.086	mg/kg	3.64E-04			3.13E-05	mg/kg-day	2.00E-05	mg/kg/day	1.57E+00
	DDD, p,p'-	0.0203	mg/kg	3.64E-04			7.39E-06	mg/kg-day	2.00E-03	mg/kg/day	3.70E-03
	DDE, p,p'-	0.0424	mg/kg	3.64E-04			1.54E-05	mg/kg-day	2.00E-03	mg/kg/day	7.72E-03
Total											2.27E+00
Grand Total											2.27E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	2.68E-02
Target organ across all exposure pathways: Gastrointestinal System =	3.38E-02
Target organ across all exposure pathways: Immune system =	2.17E+00
Target organ across all exposure pathways: Liver =	1.14E-02
Target organ across all exposure pathways: Whole body/growth =	2.60E-02

TABLE C-12 Grove Pond
Recreational Child
Sediment

		EPC		Cancer Risk Calculations							
Exposure Route	List of Chemicals of Potential Concern	Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	20300	mg/kg	2.05E-07			4.15E-03		NC	NC	
	Antimony	11.9	mg/kg	2.05E-07			2.44E-06		NC	NC	
	Arsenic	158	mg/kg	2.05E-07			3.23E-05		1.50E+00	(mg/kg-day)-1	4.85E-05
	Barium	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Cadmium (in solid media)	48.6	mg/kg	2.05E-07			9.95E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	144	mg/kg	2.05E-07			2.95E-05		NC	NC	
	Copper	795	mg/kg	2.05E-07			1.63E-04		NC	NC	
	Iron	19100	mg/kg	2.05E-07			3.91E-03		NC	NC	
	Lead	382	mg/kg	2.05E-07			7.82E-05		NA	NA	
	Manganese (in sediment or water)	721	mg/kg	2.05E-07			1.48E-04		NC	NC	
	Manganese (in food)	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Mercury	94.4	mg/kg	2.05E-07			1.93E-05		NC	NC	
	Selenium	9.76	mg/kg	2.05E-07			2.00E-06		NC	NC	
	Thallium	26.4	mg/kg	2.05E-07			5.40E-06		NC	NC	
	Vanadium	42.7	mg/kg	2.05E-07			8.74E-06		NC	NC	
	Zinc	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	2.05E-07			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.05E-07			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	2.05E-07			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0.684	mg/kg	2.05E-07			1.40E-07		7.30E-01	(mg/kg-day)-1	1.02E-07
	Benzo(a)pyrene	0.729	mg/kg	2.05E-07			1.49E-07		7.30E+00	(mg/kg-day)-1	1.09E-06
	Benzo(b)fluoranthene	0.85	mg/kg	2.05E-07			1.74E-07		7.30E-01	(mg/kg-day)-1	1.27E-07
	Benzo(k)fluoranthene	0.839	mg/kg	2.05E-07			1.72E-07		7.30E-02	(mg/kg-day)-1	1.25E-08
	Chrysene	1.1	mg/kg	2.05E-07			2.25E-07		7.30E-03	(mg/kg-day)-1	1.64E-09
	Dibenz(ah)anthracene	0.263	mg/kg	2.05E-07			5.38E-08		7.30E+00	(mg/kg-day)-1	3.93E-07
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	2.05E-07			1.31E-07		7.30E-01	(mg/kg-day)-1	9.58E-08
	Naphthalene	3.84	mg/kg	2.05E-07			7.86E-07		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.05E-07			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/kg	2.05E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	2.05E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0.381	mg/kg	2.05E-07			7.80E-08		2.40E-01	(mg/kg-day)-1	1.87E-08
	DDE, p,p'-	0	mg/kg	2.05E-07			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											5.03E-05

TABLE C-12 Grove Pond
Recreational Child
Sediment

		EPC		Cancer Risk Calculations							
Exposure Route	List of Chemicals of Potential Concern	Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	23300	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Antimony	11.9	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Arsenic	158	mg/kg	1.69E+00	1.00E-06	3.00E-02	8.00E-06		1.50E+00	(mg/kg-day)-1	1.20E-05
	Barium	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Cadmium (in solid media)	48.6	mg/kg	1.69E+00	1.00E-06	1.00E-03	8.21E-08		NC	NC	
	Cadmium (in water)					NA			NC	NC	
	Chromium, total	144	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Copper	795	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Iron	19100	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Lead	382	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NA	NA	
	Manganese (in sediment or water)	721	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Manganese (in food)	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Mercury	94.4	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Selenium	9.76	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Thallium	28.4	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Vanadium	42.7	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Zinc	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Chloroform	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.69E+00	1.00E-06	4.00E-02	0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		7.50E-03	(mg/kg-day)-1	
	Benz(a)anthracene	0.684	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.50E-07		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	0.729	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.60E-07		7.30E+00	(mg/kg-day)-1	1.17E-06
	Benzo(b)fluoranthene	0.85	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.87E-07		7.30E-01	(mg/kg-day)-1	1.36E-07
	Benzo(k)fluoranthene	0.839	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.84E-07		7.30E-02	(mg/kg-day)-1	1.34E-08
	Chrysene	1.1	mg/kg	1.69E+00	1.00E-06	1.30E-01	2.41E-07		7.30E-03	(mg/kg-day)-1	1.76E-09
	Dibenz(ah)anthracene	0.263	mg/kg	1.69E+00	1.00E-06	1.30E-01	5.77E-08		7.30E+00	(mg/kg-day)-1	4.21E-07
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.41E-07		7.30E-01	(mg/kg-day)-1	1.03E-07
	Naphthalene	3.84	mg/kg	1.69E+00	1.00E-06	1.30E-01	8.43E-07		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.69E+00	1.00E-06	1.00E-01	0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.69E+00	1.00E-06	1.40E-01	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.69E+00	1.00E-06	1.40E-01	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0.381	mg/kg	1.69E+00	1.00E-06	3.00E-02	1.93E-08		2.40E-01	(mg/kg-day)-1	4.63E-09
	DDE, p,p'-	0	mg/kg	1.69E+00	1.00E-06	3.00E-02	0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											1.39E-05
Grand Total											6.42E-05

TABLE C-12 Grove Pond
Recreational Child
Sediment

		EPC		Non-Cancer Hazard Calculations							
Exposure Route	List of Chemicals of Potential Concern	Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	20300	mg/kg	2.39E-06			4.85E-02	mg/kg-day	1.00E+00	mg/kg/day	4.85E-02
	Antimony	11.9	mg/kg	2.39E-06			2.84E-05	mg/kg-day	4.00E-04	mg/kg/day	7.10E-02
	Arsenic	158	mg/kg	2.39E-06			3.77E-04	mg/kg-day	3.00E-04	mg/kg/day	1.26E+00
	Barium	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	48.6	mg/kg	2.39E-06			1.16E-04	mg/kg-day	1.00E-03	mg/kg/day	1.16E-01
	Cadmium (in water)			2.39E-06			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	144	mg/kg	2.39E-06			3.44E-04	mg/kg-day	3.00E-03	mg/kg/day	1.15E-01
	Copper	795	mg/kg	2.39E-06			1.90E-03	mg/kg-day	3.70E-02	mg/kg/day	5.13E-02
	Iron	19100	mg/kg	2.39E-06			4.56E-02	mg/kg-day	3.00E-01	mg/kg/day	1.52E-01
	Lead	382	mg/kg	2.39E-06			9.12E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	721	mg/kg	2.39E-06			1.72E-03	mg/kg-day	2.40E-02	mg/kg/day	7.17E-02
	Manganese (in food)	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	94.4	mg/kg	2.39E-06			2.26E-04	mg/kg-day	3.00E-04	mg/kg/day	7.51E-01
	Selenium	9.76	mg/kg	2.39E-06			2.33E-05	mg/kg-day	5.00E-03	mg/kg/day	4.66E-03
	Thallium	26.4	mg/kg	2.39E-06			6.30E-05	mg/kg-day	6.60E-05	mg/kg/day	9.55E-01
	Vanadium	42.7	mg/kg	2.39E-06			1.02E-04	mg/kg-day	1.00E-03	mg/kg/day	1.02E-01
	Zinc	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0.684	mg/kg	2.39E-06			1.63E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0.729	mg/kg	2.39E-06			1.74E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0.85	mg/kg	2.39E-06			2.03E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0.839	mg/kg	2.39E-06			2.00E-06	mg/kg-day	NA	NA	
	Chrysene	1.1	mg/kg	2.39E-06			2.63E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.263	mg/kg	2.39E-06			6.28E-07	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	2.39E-06			1.53E-06	mg/kg-day	NA	NA	
	Naphthalene	3.84	mg/kg	2.39E-06			9.17E-06	mg/kg-day	2.00E-02	mg/kg/day	4.58E-04
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0.381	mg/kg	2.39E-06			9.10E-07	mg/kg-day	2.00E-03	mg/kg/day	4.55E-04
	DDE, p,p'-	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											3.70E+00

TABLE C-12 Grove Pond
Recreational Child
Sediment

		EPC		Non-Cancer Hazard Calculations							
Exposure Route	List of Chemicals of Potential Concern	Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	20300	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	11.9	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	158	mg/kg	1.97E+01	1.00E-06	3.00E-02	9.34E-05	mg/kg-day	3.00E-04	mg/kg-day	3.11E-01
	Barium	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.40E-02	mg/kg-day	
	Cadmium (in solid media)	48.6	mg/kg	1.97E+01	1.00E-06	1.00E-03	9.57E-07	mg/kg-day	2.50E-05	mg/kg-day	3.83E-02
	Cadmium (in water)			1.97E+01	1.00E-06	NA	#VALUE!	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	144	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.90E-05	mg/kg-day	
	Copper	795	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	19100	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Lead	382	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	721	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	9.60E-04	mg/kg-day	
	Manganese (in food)	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	94.4	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	9.76	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	26.4	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	42.7	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Chloroform	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.97E+01	1.00E-06	4.00E-02	0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	
	Methylene chloride	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	0.684	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.75E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0.729	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.87E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0.85	mg/kg	1.97E+01	1.00E-06	1.30E-01	2.18E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0.839	mg/kg	1.97E+01	1.00E-06	1.30E-01	2.15E-06	mg/kg-day	NA	NA	
	Chrysene	1.1	mg/kg	1.97E+01	1.00E-06	1.30E-01	2.82E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.263	mg/kg	1.97E+01	1.00E-06	1.30E-01	6.73E-07	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.64E-06	mg/kg-day	NA	NA	
	Naphthalene	3.84	mg/kg	1.97E+01	1.00E-06	1.30E-01	9.83E-06	mg/kg-day	2.00E-02	mg/kg-day	4.92E-04
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.97E+01	1.00E-06	1.00E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/kg	1.97E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/kg	1.97E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0.381	mg/kg	1.97E+01	1.00E-06	3.00E-02	2.25E-07	mg/kg-day	2.00E-03	mg/kg-day	1.13E-04
	DDE, p,p'-	0	mg/kg	1.97E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											3.50E-01
Grand Total											4.05E+00

Target organ across all exposure pathways: Central nervous system =	1.25E-01
Target organ across all exposure pathways: Blood =	7.10E-02
Target organ across all exposure pathways: Skin =	1.57E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.54E-01
Target organ across all exposure pathways: Gastrointestinal System =	3.18E-01
Target organ across all exposure pathways: Immune system =	7.51E-01
Target organ across all exposure pathways: Liver =	9.56E-01
Target organ across all exposure pathways: Whole body/growth =	1.03E-01

TABLE C-13 Grove Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
Ingestion	Aluminum	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Antimony	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Arsenic	0.0767	mg/L	2.05E-04			1.57E-05		1.50E+00	(mg/kg-day)-1	2.35E-05
	Barium	6.99	mg/L	2.05E-04			1.43E-03		NC	NC	
	Cadmium (in solid media)	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Cadmium (in water)		mg/L						NC	NC	
	Chromium, total	0.074	mg/L	2.05E-04			1.51E-05		NC	NC	
	Copper	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Iron	69.2	mg/L	2.05E-04			1.42E-02		NC	NC	
	Lead	0.0117	mg/L	2.05E-04			2.39E-06		NA	NA	
	Manganese (in sediment or water)	0.301	mg/L	2.05E-04			6.17E-05		NC	NC	
	Manganese (in food)	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Mercury	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Selenium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Thallium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Vanadium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Zinc	7.19	mg/L	2.05E-04			1.47E-03		NC	NC	
	Chloroform	0	mg/L	2.05E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/L	2.05E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/L	2.05E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	2.05E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	2.05E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	2.05E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	2.05E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	2.05E-04			7.16E-06		1.40E-02	(mg/kg-day)-1	1.00E-07
	PCB 1254	0	mg/L	2.05E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	2.05E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	2.05E-04			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	2.05E-04			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											2.36E-05

TABLE C-13 Grove Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event		Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Antimony	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Arsenic	0.0767	mg/L	1.68E+00	3.07E-07		5.15E-07		1.50E+00	(mg/kg-day)-1	7.73E-07
	Barium	6.99	mg/L	1.68E+00	2.80E-05		4.69E-05		NC	NC	
	Cadmium (in solid media)	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in water)				0.00E+00		0.00E+00		NC	NC	
	Chromium, total	0.074	mg/L	1.68E+00	5.92E-07		9.94E-07		NC	NC	
	Copper	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Iron	69.2	mg/L	1.68E+00	2.77E-04		4.65E-04		NC	NC	
	Lead	0.0117	mg/L	1.68E+00	4.68E-08		7.86E-08		NA	NA	
	Manganese (in sediment or water)	0.301	mg/L	1.68E+00	1.20E-06		2.02E-06		NC	NC	
	Manganese (in food)	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Mercury	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Selenium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Thallium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Vanadium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Zinc	7.19	mg/L	1.68E+00	1.73E-05		2.90E-05		NC	NC	
	Chloroform	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	1.68E+00	1.97E-05		3.31E-05		1.40E-02	(mg/kg-day)-1	4.64E-07
	PCB 1254	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											1.24E-06
Grand Total											2.49E-05

TABLE C-13 Grove Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
Ingestion	*Aluminum*	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0767	mg/L	2.39E-03			1.83E-04	mg/kg-day	3.00E-04	mg/kg/day	6.10E-01
	Barium	6.99	mg/L	2.39E-03			1.67E-02	mg/kg-day	2.00E-01	mg/kg/day	8.34E-02
	Cadmium (in solid media)	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)		mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.074	mg/L	2.39E-03			1.77E-04	mg/kg-day	3.00E-03	mg/kg/day	5.89E-02
	Copper	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	69.2	mg/L	2.39E-03			1.65E-01	mg/kg-day	3.00E-01	mg/kg/day	5.51E-01
	Lead	0.0117	mg/L	2.39E-03			2.79E-05	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.301	mg/L	2.39E-03			7.19E-04	mg/kg-day	2.40E-02	mg/kg/day	3.00E-02
	Manganese (in food)	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Selenium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Zinc	7.19	mg/L	2.39E-03			1.72E-02	mg/kg-day	3.00E-01	mg/kg/day	5.72E-02
	Chloroform	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	2.39E-03			8.36E-05	mg/kg-day	2.00E-02	mg/kg/day	4.18E-03
	PCB 1254	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											

TABLE C-13 Grove Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Non-Cancer Hazard Calculations: Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
				Intake Factor	DA event		Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	0.0767	mg/L	1.96E+01	3.07E-07		6.01E-06	mg/kg-day	3.00E-04	mg/kg-day	2.00E-02
	Barium	6.99	mg/L	1.96E+01	2.80E-05		5.48E-04	mg/kg-day	1.40E-02	mg/kg-day	3.91E-02
	Cadmium (in solid media)	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	0.00E+00
	Cadmium (in water)			1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	0.074	mg/L	1.96E+01	5.92E-07		1.16E-05	mg/kg-day	3.90E-05	mg/kg-day	2.97E-01
	Copper	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	69.2	mg/L	1.96E+01	2.77E-04		5.42E-03	mg/kg-day	3.00E-01	mg/kg-day	1.81E-02
	Lead	0.0117	mg/L	1.96E+01	4.68E-08		9.17E-07	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.301	mg/L	1.96E+01	1.20E-06		2.28E-05	mg/kgday	9.60E-04	mg/kg-day	2.38E-02
	Manganese (in food)	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	7.19	mg/L	1.96E+01	1.73E-05		3.38E-04	mg/kg-day	3.00E-01	mg/kg-day	1.13E-03
	Chloroform	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	
	Methylene chloride	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	1.96E+01	1.97E-05		3.87E-04	mg/kg-day	2.00E-02	mg/kg-day	1.93E-02
	PCB 1254	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											4.24E-01
Grand Total											1.85E+00

Target organ across all exposure pathways: Central nervous system =	5.38E-02
Target organ across all exposure pathways: Blood =	5.83E-02
Target organ across all exposure pathways: Skin =	6.30E-01
Target organ across all exposure pathways: Cardiovascular system =	1.23E-01
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	9.25E-01
Target organ across all exposure pathways: Immune system =	0.00E+00
Target organ across all exposure pathways: Liver =	2.35E-02
Target organ across all exposure pathways: Whole body/growth =	0.00E+00

TABLE C-14 Grove Pond
Recreational Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Antimony	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Arsenic	0	mg/kg	5.46E-05			0.00E+00		1.50E+00	(mg/kg-day)-1	0.00E+00
	Barium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Cadmium (in solid media)	0.0736	mg/kg	5.46E-05			4.02E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0.278	mg/kg	5.46E-05			1.52E-05		NC	NC	
	Copper	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Iron	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Lead	0.815	mg/kg	5.46E-05			4.45E-05		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Mercury	0.497	mg/kg	5.46E-05			2.71E-05		NC	NC	
	Selenium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Thallium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Vanadium	0.0715	mg/kg	5.46E-05			3.90E-06		NC	NC	
	Zinc	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	5.46E-05			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	5.46E-05			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	5.46E-05			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	5.46E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	5.46E-05			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	5.46E-05			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	5.46E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	5.46E-05			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	5.46E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0.086	mg/kg	5.46E-05			4.69E-06		2.00E+00	(mg/kg-day)-1	9.38E-06
	DDD, p,p'-	0.0203	mg/kg	5.46E-05			1.11E-06		2.40E-01	(mg/kg-day)-1	2.66E-07
	DDE, p,p'-	0.0424	mg/kg	5.46E-05			2.31E-06		3.40E-01	(mg/kg-day)-1	7.87E-07
Total											1.04E-05
Grand Total											1.04E-05

TABLE C-14 Grove Pond
Recreational Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Barium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0.0736	mg/kg	6.37E-04			4.68E-05	mg/kg-day	1.00E-03	mg/kg/day	4.68E-02
	Cadmium (in water)			6.37E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.278	mg/kg	6.37E-04			1.77E-04	mg/kg-day	3.00E-03	mg/kg/day	5.90E-02
	Copper	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0.815	mg/kg	6.37E-04			5.19E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0.497	mg/kg	6.37E-04			3.16E-04	mg/kg-day	3.00E-04	mg/kg/day	1.05E+00
	Selenium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.0715	mg/kg	6.37E-04			4.55E-05	mg/kg-day	1.00E-03	mg/kg/day	4.55E-02
	Zinc	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0.086	mg/kg	6.37E-04			5.47E-05	mg/kg-day	2.00E-05	mg/kg/day	2.74E+00
	DDD, p,p'-	0.0203	mg/kg	6.37E-04			1.29E-05	mg/kg-day	2.00E-03	mg/kg/day	6.46E-03
	DDE, p,p'-	0.0424	mg/kg	6.37E-04			2.70E-05	mg/kg-day	2.00E-03	mg/kg/day	1.35E-02
Total											3.96E+00
Grand Total											3.96E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	4.68E-02
Target organ across all exposure pathways: Gastrointestinal System =	5.90E-02
Target organ across all exposure pathways: Immune system =	3.79E+00
Target organ across all exposure pathways: Liver =	2.00E-02
Target organ across all exposure pathways: Whole body/growth =	4.55E-02

TABLE C-15 Grove Pond
Subsistance Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Antimony	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Arsenic	0	mg/kg	1.04E-03			0.00E+00		1.50E+00	(mg/kg-day)-1	0.00E+00
	Barium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Cadmium (in solid media)	0.0736	mg/kg	1.04E-03			7.65E-05		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0.278	mg/kg	1.04E-03			2.89E-04		NC	NC	
	Copper	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Iron	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Lead	0.815	mg/kg	1.04E-03			8.47E-04		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Mercury	0.497	mg/kg	1.04E-03			5.17E-04		NC	NC	
	Selenium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Thallium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Vanadium	0.0715	mg/kg	1.04E-03			7.43E-05		NC	NC	
	Zinc	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.04E-03			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.04E-03			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.04E-03			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	1.04E-03			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	1.04E-03			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	1.04E-03			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	1.04E-03			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.04E-03			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.04E-03			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0.086	mg/kg	1.04E-03			8.94E-05		2.00E+00	(mg/kg-day)-1	1.79E-04
	DDD, p,p'-	0.0203	mg/kg	1.04E-03			2.11E-05		2.40E-01	(mg/kg-day)-1	5.06E-06
	DDE, p,p'-	0.0424	mg/kg	1.04E-03			4.41E-05		3.40E-01	(mg/kg-day)-1	1.50E-05
Total											1.99E-04
Grand Total											1.99E-04

TABLE C-15 Grove Pond
Subsistance Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Barium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0.0736	mg/kg	2.43E-03			1.79E-04	mg/kg-day	1.00E-03	mg/kg/day	1.79E-01
	Cadmium (in water)			2.43E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.278	mg/kg	2.43E-03			6.74E-04	mg/kg-day	3.00E-03	mg/kg/day	2.25E-01
	Copper	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0.815	mg/kg	2.43E-03			1.98E-03	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0.497	mg/kg	2.43E-03			1.21E-03	mg/kg-day	3.00E-04	mg/kg/day	4.02E+00
	Selenium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.0715	mg/kg	2.43E-03			1.73E-04	mg/kg-day	1.00E-03	mg/kg/day	1.73E-01
	Zinc	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0.086	mg/kg	2.43E-03			2.09E-04	mg/kg-day	2.00E-05	mg/kg/day	1.04E+01
	DDD, p,p'-	0.0203	mg/kg	2.43E-03			4.92E-05	mg/kg-day	2.00E-03	mg/kg/day	2.46E-02
	DDE, p,p'-	0.0424	mg/kg	2.43E-03			1.03E-04	mg/kg-day	2.00E-03	mg/kg/day	5.14E-02
Total											1.51E+01
Grand Total											1.51E+01

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.79E-01
Target organ across all exposure pathways: Gastrointestinal System =	2.25E-01
Target organ across all exposure pathways: Immune system =	1.44E+01
Target organ across all exposure pathways: Liver =	7.60E-02
Target organ across all exposure pathways: Whole body/growth =	1.73E-01

TABLE C-16 Grove Pond
Subsistance Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Antimony	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Arsenic	0	mg/kg	3.63E-04			0.00E+00		1.50E+00	(mg/kg-day)-1	0.00E+00
	Barium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0.0736	mg/kg	3.63E-04			2.67E-05		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0.278	mg/kg	3.63E-04			1.01E-04		NC	NC	
	Copper	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Iron	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Lead	0.815	mg/kg	3.63E-04			2.96E-04		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Mercury	0.497	mg/kg	3.63E-04			1.81E-04		NC	NC	
	Selenium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Thallium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Vanadium	0.0715	mg/kg	3.63E-04			2.60E-05		NC	NC	
	Zinc	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	3.63E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	3.63E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	3.63E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	3.63E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	3.63E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	3.63E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	3.63E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	3.63E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	3.63E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0.086	mg/kg	3.63E-04			3.12E-05		2.00E+00	(mg/kg-day)-1	6.25E-05
	DDD, p,p'-	0.0203	mg/kg	3.63E-04			7.37E-06		2.40E-01	(mg/kg-day)-1	1.77E-06
	DDE, p,p'-	0.0424	mg/kg	3.63E-04			1.54E-05		3.40E-01	(mg/kg-day)-1	5.24E-06
Total											6.95E-05
Grand Total											6.95E-05

TABLE C-16 Grove Pond
Subsistance Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Non-Cancer Hazard Calculations: Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
Ingestion	Aluminum	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Barium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0.0736	mg/kg	8.48E-04			6.24E-05	mg/kg-day	1.00E-03	mg/kg/day	6.24E-02
	Cadmium (in water)			8.48E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.278	mg/kg	8.48E-04			2.36E-04	mg/kg-day	3.00E-03	mg/kg/day	7.86E-02
	Copper	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0.815	mg/kg	8.48E-04			6.91E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0.497	mg/kg	8.48E-04			4.21E-04	mg/kg-day	3.00E-04	mg/kg/day	1.40E+00
	Selenium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.0715	mg/kg	8.48E-04			6.06E-05	mg/kg-day	1.00E-03	mg/kg/day	6.06E-02
	Zinc	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0.086	mg/kg	8.48E-04			7.29E-05	mg/kg-day	2.00E-05	mg/kg/day	3.64E+00
	DDD, p,p'-	0.0203	mg/kg	8.48E-04			1.72E-05	mg/kg-day	2.00E-03	mg/kg/day	8.60E-03
	DDE, p,p'-	0.0424	mg/kg	8.48E-04			3.59E-05	mg/kg-day	2.00E-03	mg/kg/day	1.80E-02
Total											5.28E+00
Grand Total											5.28E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	6.24E-02
Target organ across all exposure pathways: Gastrointestinal System =	7.86E-02
Target organ across all exposure pathways: Immune system =	5.05E+00
Target organ across all exposure pathways: Liver =	2.66E-02
Target organ across all exposure pathways: Whole body/growth =	6.06E-02

TABLE C-17 Plow Shop Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	9660	mg/kg	1.10E-07			1.06E-03		NC	NC	
	Antimony	17.1	mg/kg	1.10E-07			1.87E-06		NC	NC	
	Arsenic	930	mg/kg	1.10E-07			1.02E-04		1.50E+00	(mg/kg-day)-1	1.53E-04
	Barium	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Cadmium (in solid media)	15.3	mg/kg	1.10E-07			1.68E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	12200	mg/kg	1.10E-07			1.34E-03		NC	NC	
	Copper	297	mg/kg	1.10E-07			3.26E-05		NC	NC	
	Iron	96300	mg/kg	1.10E-07			1.06E-02		NC	NC	
	Lead	229	mg/kg	1.10E-07			2.51E-05		NA	NA	
	Manganese (in sediment or water)	3020	mg/kg	1.10E-07			3.31E-04		NC	NC	
	Manganese (in food)	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Mercury	34.7	mg/kg	1.10E-07			3.80E-06		NC	NC	
	Selenium	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Thallium	13.4	mg/kg	1.10E-07			1.47E-06		NC	NC	
	Vanadium	35.6	mg/kg	1.10E-07			3.90E-06		NC	NC	
	Zinc	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.10E-07			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.10E-07			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.10E-07			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	3.65	mg/kg	1.10E-07			4.00E-07		7.30E-01	(mg/kg-day)-1	2.92E-07
	Benzo(a)pyrene	4.67	mg/kg	1.10E-07			5.12E-07		7.30E+00	(mg/kg-day)-1	3.74E-06
	Benzo(b)fluoranthene	3.9	mg/kg	1.10E-07			4.28E-07		7.30E-01	(mg/kg-day)-1	3.12E-07
	Benzo(k)fluoranthene	1.44	mg/kg	1.10E-07			1.58E-07		7.30E-02	(mg/kg-day)-1	1.15E-08
	Chrysene	4.28	mg/kg	1.10E-07			4.69E-07		7.30E-03	(mg/kg-day)-1	3.43E-09
	Dibenz(ah)anthracene	0.96	mg/kg	1.10E-07			1.05E-07		7.30E+00	(mg/kg-day)-1	7.68E-07
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	1.10E-07			4.01E-07		7.30E-01	(mg/kg-day)-1	2.93E-07
	Naphthalene	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.10E-07			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/kg	1.10E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.10E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	1.10E-07			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/kg	1.10E-07			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											1.58E-04

TABLE C-17 Plow Shop Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
				Intake Factor	DA event factor	ABSd	Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	9980	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Antimony	17.1	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Arsenic	930	mg/kg	4.93E+00	1.00E-06	0.03	1.38E-04		1.50E+00	(mg/kg-day)-1	2.06E-04
	Barium	0	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Cadmium (in solid media)	15.3	mg/kg	4.93E+00	1.00E-06	0.001	7.55E-08		NC	NC	
	Cadmium (in water)					NA			NC	NC	
	Chromium, total	12200	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Copper	297	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Iron	96300	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Lead	229	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NA	NA	
	Manganese (in sediment or water)	3023	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Manganese (in food)	0	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Mercury	34.7	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Selenium	0	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Thallium	13.4	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Vanadium	35.6	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Zinc	0	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NC	NC	
	Chloroform	0	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	4.93E+00	1.00E-06	0.04	0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/kg	4.93E+00	1.00E-06	—	#VALUE!		7.50E-03	(mg/kg-day)-1	
	Benz(a)anthracene	3.65	mg/kg	4.93E+00	1.00E-06	0.13	2.34E-06		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	4.67	mg/kg	4.93E+00	1.00E-06	0.13	3.00E-06		7.30E+00	(mg/kg-day)-1	2.19E-05
	Benzo(b)fluoranthene	3.9	mg/kg	4.93E+00	1.00E-06	0.13	2.50E-06		7.30E-01	(mg/kg-day)-1	1.83E-06
	Benzo(k)fluoranthene	1.44	mg/kg	4.93E+00	1.00E-06	0.13	9.24E-07		7.30E-02	(mg/kg-day)-1	6.74E-08
	Chrysene	4.28	mg/kg	4.93E+00	1.00E-06	0.13	2.74E-06		7.30E-03	(mg/kg-day)-1	2.00E-08
	Dibenz(ah)anthracene	0.96	mg/kg	4.93E+00	1.00E-06	0.13	6.16E-07		7.30E+00	(mg/kg-day)-1	4.49E-06
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	4.93E+00	1.00E-06	0.13	2.35E-06		7.30E-01	(mg/kg-day)-1	1.71E-06
	Naphthalene	0	mg/kg	4.93E+00	1.00E-06	0.13	0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	4.93E+00	1.00E-06	0.1	0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	4.93E+00	1.00E-06	0.14	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	4.93E+00	1.00E-06	0.14	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	4.93E+00	1.00E-06	0.03	0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/kg	4.93E+00	1.00E-06	0.03	0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											2.30E-04
Grand Total											3.05E-04

TABLE C-17 Plow Shop Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
Ingestion	Aluminum	9660	mg/kg	2.56E-07			2.47E-03	mg/kg-day	1.00E+00	mg/kg/day	2.47E-03
	Antimony	17.1	mg/kg	2.56E-07			4.37E-06	mg/kg-day	4.00E-04	mg/kg/day	1.09E-02
	Arsenic	930	mg/kg	2.56E-07			2.38E-04	mg/kg-day	3.00E-04	mg/kg/day	7.93E-01
	Barium	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	15.3	mg/kg	2.56E-07			3.91E-06	mg/kg-day	1.00E-03	mg/kg/day	3.91E-03
	Cadmium (in water)			2.56E-07			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	12200	mg/kg	2.56E-07			3.12E-03	mg/kg-day	3.00E-03	mg/kg/day	1.04E+00
	Copper	297	mg/kg	2.56E-07			7.60E-05	mg/kg-day	3.70E-02	mg/kg/day	2.05E-03
	Iron	96300	mg/kg	2.56E-07			2.46E-02	mg/kg-day	3.00E-01	mg/kg/day	8.21E-02
	Lead	229	mg/kg	2.56E-07			5.86E-05	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	3020	mg/kg	2.56E-07			7.73E-04	mg/kg-day	2.40E-02	mg/kg/day	3.22E-02
	Manganese (in food)	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	34.7	mg/kg	2.56E-07			8.88E-06	mg/kg-day	3.00E-04	mg/kg/day	2.96E-02
	Selenium	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	13.4	mg/kg	2.56E-07			3.43E-06	mg/kg-day	6.60E-05	mg/kg/day	5.19E-02
	Vanadium	35.6	mg/kg	2.56E-07			9.11E-06	mg/kg-day	1.00E-03	mg/kg/day	9.11E-03
	Zinc	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	3.65	mg/kg	2.56E-07			9.34E-07	mg/kg-day	NA	NA	
	Benzo(a)pyrene	4.67	mg/kg	2.56E-07			1.19E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.9	mg/kg	2.56E-07			9.98E-07	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.44	mg/kg	2.56E-07			3.68E-07	mg/kg-day	NA	NA	
	Chrysene	4.26	mg/kg	2.56E-07			1.09E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.96	mg/kg	2.56E-07			2.46E-07	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	2.56E-07			9.36E-07	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											2.06E+00

TABLE C-17 Plow Shop Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	9660	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	17.1	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	930	mg/kg	1.15E+01	1.00E-06	3.00E-02	3.21E-04	mg/kg-day	3.00E-04	mg/kg-day	1.07E+00
	Barium	0	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	1.40E-02	mg/kg-day	
	Cadmium (in solid media)	15.3	mg/kg	1.15E+01	1.00E-06	1.00E-03	1.76E-07	mg/kg-day	2.50E-05	mg/kg-day	7.04E-03
	Cadmium (in water)			1.15E+01	1.00E-06	NA	#VALUE!	mg/kg-day	2.50E-06	mg/kg-day	
	Chromium, total	12200	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	3.90E-06	mg/kg-day	
	Copper	297	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	96300	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Lead	229	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	3020	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	9.60E-04	mg/kg-day	
	Manganese (in food)	0	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	34.7	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	13.4	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	35.6	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Chloroform	0	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.15E+01	1.00E-06	4.00E-02	0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	0.00E+00
	Methylene chloride	0	mg/kg	1.15E+01	1.00E-06		#VALUE!	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	3.65	mg/kg	1.15E+01	1.00E-06	1.30E-01	5.46E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	4.67	mg/kg	1.15E+01	1.00E-06	1.30E-01	6.99E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.9	mg/kg	1.15E+01	1.00E-06	1.30E-01	5.84E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.44	mg/kg	1.15E+01	1.00E-06	1.30E-01	2.15E-06	mg/kg-day	NA	NA	
	Chrysene	4.28	mg/kg	1.15E+01	1.00E-06	1.30E-01	6.40E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.96	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.44E-06	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	1.15E+01	1.00E-06	1.30E-01	5.48E-06	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	1.15E+01	1.00E-06	1.30E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhoxyl) phthalate	0	mg/kg	1.15E+01	1.00E-06	1.00E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/kg	1.15E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/kg	1.15E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/kg	1.15E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/kg	1.15E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											1.08E+00
Grand Total											3.14E+00

Target organ across all exposure pathways: Central nervous system =	3.47E-02
Target organ across all exposure pathways: Blood =	1.09E-02
Target organ across all exposure pathways: Skin =	1.88E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.10E-02
Target organ across all exposure pathways: Gastrointestinal System =	1.12E+00
Target organ across all exposure pathways: Immune system =	2.96E-02
Target organ across all exposure pathways: Liver =	5.19E-02
Target organ across all exposure pathways: Whole body/growth =	9.11E-03

TABLE C-18 Plow Shop Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Antimony	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Arsenic	0.151	mg/L	4.39E-05			6.62E-06		1.50E+00	(mg/kg-day)-1	9.93E-06
	Barium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Cadmium (in water)		mg/L						NC	NC	
	Chromium, total	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Copper	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Iron	5.97	mg/L	4.39E-05			2.62E-04		NC	NC	
	Lead	0.000379	mg/L	4.39E-05			1.66E-08		NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	4.39E-05			6.49E-06		NC	NC	
	Manganese (in food)	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Mercury	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Selenium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Thallium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Vanadium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Zinc	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Chloroform	0.00131	mg/L	4.39E-05			5.74E-08		NA	NA	
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	4.39E-05			2.30E-09		6.30E+00	(mg/kg-day)-1	1.45E-08
	Methylene chloride	0.00804	mg/L	4.39E-05			3.53E-07		7.50E-03	(mg/kg-day)-1	2.64E-09
	Benz(a)anthracene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	4.39E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	4.39E-05			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	4.39E-05			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	4.39E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/L	4.39E-05			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/L	4.39E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	4.39E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	4.39E-05			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	4.39E-05			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											9.95E-06

TABLE C-18 Plow Shop Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event		Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Antimony	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Arsenic	0.151	mg/L	4.91E+00	6.04E-07		2.96E-06		1.50E+00	(mg/kg-day)-1	4.45E-06
	Barium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in water)				0.00E+00		0.00E+00		NC	NC	
	Chromium, total	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Copper	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Iron	5.97	mg/L	4.91E+00	2.39E-05		1.17E-04		NC	NC	
	Lead	0.000379	mg/L	4.91E+00	1.52E-09		7.44E-09		NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	4.91E+00	5.92E-07		2.90E-06		NC	NC	
	Manganese (in food)	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Mercury	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Selenium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Thallium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Vanadium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Zinc	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Chloroform	0.00131	mg/L	4.91E+00	4.45E-08		2.19E-07		NA	NA	
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	4.91E+00	6.81E-09		3.34E-08		6.30E+00	(mg/kg-day)-1	2.11E-07
	Methylene chloride	0.03804	mg/L	4.91E+00	1.31E-07		6.41E-07		7.50E-03	(mg/kg-day)-1	4.80E-09
	Benz(a)anthracene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/L	4.91E+00	0.00E+00		0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											4.66E-06
Grand Total											1.46E-05

TABLE C-16 Plow Shop Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.151	mg/L	1.02E-04			1.55E-05	mg/kg-day	3.00E-04	mg/kg/day	5.15E-02
	Barium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)		mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	5.97	mg/L	1.02E-04			6.11E-04	mg/kg-day	3.00E-01	mg/kg/day	2.04E-03
	Lead	0.000379	mg/L	1.02E-04			3.88E-08	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	1.02E-04			1.51E-05	mg/kg-day	2.40E-02	mg/kg/day	6.31E-04
	Manganese (in food)	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Selenium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Zinc	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0.00131	mg/L	1.02E-04			1.34E-07	mg/kg-day	1.00E-02	mg/kg/day	1.34E-05
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	1.02E-04			5.36E-09	mg/kg-day	5.00E-04	mg/kg/day	1.07E-05
	Methylene chloride	0.00804	mg/L	1.02E-04			8.23E-07	mg/kg-day	6.00E-02	mg/kg/day	1.37E-05
	Benz(a)anthracene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											5.42E-02

TABLE C-18 Plow Shop Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event		Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	0.151	mg/L	2.45E+01	6.04E-07		1.48E-05	mg/kg-day	3.00E-04	mg/kg-day	4.94E-02
	Barium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	1.40E-02	mg/kg-day	0.00E+00
	Cadmium (in solid media)	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	0.00E+00
	Cadmium (in water)			2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	3.90E-05	mg/kg-day	0.00E+00
	Copper	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	5.97	mg/L	2.45E+01	2.39E-05		5.86E-04	mg/kg-day	3.00E-01	mg/kg-day	1.95E-03
	Lead	0.000379	mg/L	2.45E+01	1.52E-09		3.72E-08	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	2.45E+01	5.92E-07		1.45E-05	mg/kg-day	9.60E-04	mg/kg-day	1.51E-02
	Manganese (in food)	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	3.00E-01	mg/kg-day	0.00E+00
	Chloroform	0.00131	mg/L	2.45E+01	4.45E-08		1.09E-06	mg/kg-day	1.00E-02	mg/kg-day	1.09E-04
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	2.45E+01	6.81E-09		1.67E-07	mg/kg-day	5.00E-04	mg/kg-day	3.34E-04
	Methylene chloride	0.00804	mg/L	2.45E+01	1.31E-07		3.20E-06	mg/kg-day	6.00E-02	mg/kg-day	5.34E-05
	Benz(a)anthracene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											6.70E-02
Grand Total											1.21E-01

Target organ across all exposure pathways: Central nervous system =	1.58E-02
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	1.01E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	3.45E-04
Target organ across all exposure pathways: Gastrointestinal System =	3.99E-03
Target organ across all exposure pathways: Immune system =	0.00E+00
Target organ across all exposure pathways: Liver =	1.90E-04
Target organ across all exposure pathways: Whole body/growth =	0.00E+00

TABLE C- 19 Plow Shop Pond
Recreational Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Antimony	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Arsenic	0.0796	mg/kg	1.56E-04			1.24E-05		1.50E+00	(mg/kg-day)-1	1.86E-05
	Barium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Copper	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Iron	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Lead	0	mg/kg	1.56E-04			0.00E+00		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Mercury	2.59	mg/kg	1.56E-04			4.04E-04		NC	NC	
	Selenium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Thallium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Vanadium	0.449	mg/kg	1.56E-04			7.01E-05		NC	NC	
	Zinc	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.56E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.56E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.56E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	1.56E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	1.56E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	1.56E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	1.56E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.56E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.56E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.56E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	1.56E-04			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	1.56E-04			2.92E-06		3.40E-01	(mg/kg-day)-1	9.90E-07
Total											1.96E-05
Grand Total											1.96E-05

TABLE C- 19 Plow Shop Pond
Recreational Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0796	mg/kg	3.64E-04			2.90E-05	mg/kg-day	3.00E-04	mg/kg/day	9.67E-02
	Barium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)			3.64E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	2.59	mg/kg	3.64E-04			9.43E-04	mg/kg-day	3.00E-04	mg/kg/day	3.14E+00
	Selenium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.449	mg/kg	3.64E-04			1.64E-04	mg/kg-day	1.00E-03	mg/kg/day	1.64E-01
	Zinc	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	3.64E-04			6.81E-06	mg/kg-day	2.00E-03	mg/kg/day	3.41E-03
Total											3.41E+00
Grand Total											3.41E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	9.67E-02
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	3.14E+00
Target organ across all exposure pathways: Liver =	3.41E-03
Target organ across all exposure pathways: Whole body/growth =	1.64E-01

TABLE C-20 Plow Shop Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	9660	mg/kg	2.05E-07			1.98E-03		NC	NC	
	Antimony	17.1	mg/kg	2.05E-07			3.50E-06		NC	NC	
	Arsenic	930	mg/kg	2.05E-07			1.90E-04		1.50E+00	(mg/kg-day)-1	2.85E-04
	Barium	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Cadmium (in solid media)	15.3	mg/kg	2.05E-07			3.13E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	12200	mg/kg	2.05E-07			2.50E-03		NC	NC	
	Copper	297	mg/kg	2.05E-07			6.08E-05		NC	NC	
	Iron	96300	mg/kg	2.05E-07			1.97E-02		NC	NC	
	Lead	229	mg/kg	2.05E-07			4.69E-05		NA	NA	
	Manganese (in sediment or wa	3020	mg/kg	2.05E-07			6.18E-04		NC	NC	
	Manganese (in food)	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Mercury	34.7	mg/kg	2.05E-07			7.10E-06		NC	NC	
	Selenium	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Thallium	13.4	mg/kg	2.05E-07			2.74E-06		NC	NC	
	Vanadium	35.6	mg/kg	2.05E-07			7.29E-06		NC	NC	
	Zinc	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	2.05E-07			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha	0	mg/kg	2.05E-07			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	2.05E-07			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	3.65	mg/kg	2.05E-07			7.47E-07		7.30E-01	(mg/kg-day)-1	5.45E-07
	Benzo(a)pyrene	4.67	mg/kg	2.05E-07			9.56E-07		7.30E+00	(mg/kg-day)-1	6.98E-06
	Benzo(b)fluoranthene	3.9	mg/kg	2.05E-07			7.98E-07		7.30E-01	(mg/kg-day)-1	5.83E-07
	Benzo(k)fluoranthene	1.44	mg/kg	2.05E-07			2.95E-07		7.30E-02	(mg/kg-day)-1	2.15E-08
	Chrysene	4.28	mg/kg	2.05E-07			8.76E-07		7.30E-03	(mg/kg-day)-1	6.39E-09
	Dibenz(ah)anthracene	0.96	mg/kg	2.05E-07			1.96E-07		7.30E+00	(mg/kg-day)-1	1.43E-06
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	2.05E-07			7.49E-07		7.30E-01	(mg/kg-day)-1	5.47E-07
	Naphthalene	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.05E-07			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/kg	2.05E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	2.05E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	2.05E-07			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/kg	2.05E-07			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											2.96E-04

TABLE C-20 Plow Shop Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	9660	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Antimony	17.1	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Arsenic	930	mg/kg	1.69E+00	1.00E-06	0.03	4.71E-05		1.50E+00	(mg/kg-day)-1	7.07E-05
	Barium	0	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Cadmium (in solid media)	15.3	mg/kg	1.69E+00	1.00E-06	0.001	2.58E-08		NC	NC	
	Cadmium (in water)					NA			NC	NC	
	Chromium, total	12200	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Copper	297	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Iron	96300	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Lead	229	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NA	NA	
	Manganese (in sediment or wa	3020	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Manganese (in food)	0	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Mercury	34.7	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Selenium	0	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Thallium	13.4	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Vanadium	35.6	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Zinc	0	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NC	NC	
	Chloroform	0	mg/kg	1.69E+00	1.00E-06	———	#VALUE!		NA	NA	
	Hexachlorocyclohexane, alpha	0	mg/kg	1.69E+00	1.00E-06	0.04	0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/kg	1.69E+00	1.00E-08	———	#VALUE!		7.50E-03	(mg/kg-day)-1	
	Benz(a)anthracene	3.65	mg/kg	1.69E+00	1.00E-06	0.13	8.01E-07		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	4.67	mg/kg	1.69E+00	1.00E-06	0.13	1.02E-06		7.30E+00	(mg/kg-day)-1	7.48E-06
	Benzo(b)fluoranthene	3.9	mg/kg	1.69E+00	1.00E-06	0.13	8.56E-07		7.30E-01	(mg/kg-day)-1	6.25E-07
	Benzo(k)fluoranthene	1.44	mg/kg	1.69E+00	1.00E-06	0.13	3.16E-07		7.30E-02	(mg/kg-day)-1	2.31E-08
	Chrysene	4.28	mg/kg	1.69E+00	1.00E-06	0.13	9.39E-07		7.30E-03	(mg/kg-day)-1	6.86E-09
	Dibenz(ah)anthracene	0.96	mg/kg	1.69E+00	1.00E-06	0.13	2.11E-07		7.30E+00	(mg/kg-day)-1	1.54E-06
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	1.69E+00	1.00E-06	0.13	8.03E-07		7.30E-01	(mg/kg-day)-1	5.86E-07
	Naphthalene	0	mg/kg	1.69E+00	1.00E-06	0.13	0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.69E+00	1.00E-06	0.1	0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.69E+00	1.00E-06	0.14	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.69E+00	1.00E-06	0.14	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	1.69E+00	1.00E-06	0.03	0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/kg	1.69E+00	1.00E-06	0.03	0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											8.09E-05
Grand Total											3.77E-04

TABLE C-20 Plow Shop Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	9660	mg/kg	2.39E-06			2.31E-02	mg/kg-day	1.00E+00	mg/kg/day	2.31E-02
	Antimony	17.1	mg/kg	2.39E-06			4.08E-05	mg/kg-day	4.00E-04	mg/kg/day	1.02E-01
	Arsenic	930	mg/kg	2.39E-06			2.22E-03	mg/kg-day	3.00E-04	mg/kg/day	7.40E+00
	Barium	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	15.3	mg/kg	2.39E-06			3.65E-05	mg/kg-day	1.00E-03	mg/kg/day	3.65E-02
	Cadmium (in water)			2.39E-06			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	12200	mg/kg	2.39E-06			2.91E-02	mg/kg-day	3.00E-03	mg/kg/day	9.71E+00
	Copper	297	mg/kg	2.39E-06			7.09E-04	mg/kg-day	3.70E-02	mg/kg/day	1.92E-02
	Iron	96300	mg/kg	2.39E-06			2.30E-01	mg/kg-day	3.00E-01	mg/kg/day	7.66E-01
	Lead	229	mg/kg	2.39E-06			5.47E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or wa	3020	mg/kg	2.39E-06			7.21E-03	mg/kg-day	2.40E-02	mg/kg/day	3.00E-01
	Manganese (in food)	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	34.7	mg/kg	2.39E-06			8.28E-05	mg/kg-day	3.00E-04	mg/kg/day	2.76E-01
	Selenium	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	13.4	mg/kg	2.39E-06			3.20E-05	mg/kg-day	6.60E-05	mg/kg/day	4.85E-01
	Vanadium	35.6	mg/kg	2.39E-06			8.50E-05	mg/kg-day	1.00E-03	mg/kg/day	8.50E-02
	Zinc	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	3.65	mg/kg	2.39E-06			8.71E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	4.67	mg/kg	2.39E-06			1.11E-05	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.9	mg/kg	2.39E-06			9.31E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.44	mg/kg	2.39E-06			3.44E-06	mg/kg-day	NA	NA	
	Chrysene	4.28	mg/kg	2.39E-06			1.02E-05	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.96	mg/kg	2.39E-06			2.29E-06	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	2.39E-06			8.74E-06	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											1.92E+01

TABLE C-28 Plow Shop Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
				Intake Factor	DA event factor	ABSd	Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	9660	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	17.1	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	930	mg/kg	1.97E+01	1.00E-06	3.00E-02	5.50E-04	mg/kg-day	3.00E-04	mg/kg-day	1.83E+00
	Barium	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.40E-02	mg/kg-day	
	Cadmium (in solid media)	15.3	mg/kg	1.97E+01	1.00E-06	1.00E-03	3.01E-07	mg/kg-day	2.50E-05	mg/kg-day	1.21E-02
	Cadmium (in water)			1.97E+01	1.00E-06	NA	#VALUE!	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	12200	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.90E-05	mg/kg-day	
	Copper	297	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	96300	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Lead	229	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	NA	NA	
	Manganese (in sediment or wa	3020	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	9.60E-04	mg/kg-day	
	Manganese (in food)	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	34.7	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	13.4	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	35.6	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Chloroform	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha	0	mg/kg	1.97E+01	1.00E-06	4.00E-02	0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	0.00E+00
	Methylene chloride	0	mg/kg	1.97E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	3.65	mg/kg	1.97E+01	1.00E-06	1.30E-01	9.35E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	4.67	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.20E-05	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.9	mg/kg	1.97E+01	1.00E-06	1.30E-01	9.99E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.44	mg/kg	1.97E+01	1.00E-06	1.30E-01	3.69E-06	mg/kg-day	NA	NA	
	Chrysene	4.28	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.10E-05	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.96	mg/kg	1.97E+01	1.00E-06	1.30E-01	2.46E-06	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	1.97E+01	1.00E-06	1.30E-01	9.37E-06	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	1.97E+01	1.00E-06	1.30E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.97E+01	1.00E-06	1.00E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/kg	1.97E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/kg	1.97E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/kg	1.97E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/kg	1.97E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											1.84E+00
Grand Total											2.10E+01

Target organ across all exposure pathways: Central nervous system =	3.23E-01
Target organ across all exposure pathways: Blood =	1.02E-01
Target organ across all exposure pathways: Skin =	9.23E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	4.86E-02
Target organ across all exposure pathways: Gatrointestinal System =	1.05E+01
Target organ across all exposure pathways: Immune system =	2.76E-01
Target organ across all exposure pathways: Liver =	4.85E-01
Target organ across all exposure pathways: Whole body/growth =	8.50E-02

TABLE C-21 Plow Shop Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Antimony	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Arsenic	0.151	mg/L	2.05E-04			3.09E-05		1.50E+00	(mg/kg-day)-1	4.64E-05
	Barium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Cadmium (in water)		mg/L						NC	NC	
	Chromium, total	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Copper	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Iron	5.97	mg/L	2.05E-04			1.22E-03		NC	NC	
	Lead	0.000379	mg/L	2.05E-04			7.76E-08		NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	2.05E-04			3.03E-05		NC	NC	
	Manganese (in food)	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Mercury	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Selenium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Thallium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Vanadium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Zinc	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Chloroform	0.00131	mg/L	2.05E-04			2.68E-07		NA	NA	
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	2.05E-04			1.07E-08		6.30E+00	(mg/kg-day)-1	6.76E-08
	Methylene chloride	0.00804	mg/L	2.05E-04			1.65E-06		7.50E-03	(mg/kg-day)-1	1.23E-08
	Benz(a)anthracene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	2.05E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	2.05E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	2.05E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	2.05E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/L	2.05E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/L	2.05E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	2.05E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	2.05E-04			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	2.05E-04			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											4.64E-05

TABLE C-21 Plow Shop Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event		Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Antimony	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Arsenic	0.151	mg/L	1.68E+00	6.04E-07		1.01E-06		1.50E+00	(mg/kg-day)-1	1.52E-06
	Barium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in water)				0.00E+00		0.00E+00		NC	NC	
	Chromium, total	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Copper	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Iron	5.97	mg/L	1.68E+00	2.39E-05		4.01E-05		NC	NC	
	Lead	0.000379	mg/L	1.68E+00	1.52E-09		2.55E-09		NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	1.68E+00	5.92E-07		9.94E-07		NC	NC	
	Manganese (in food)	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Mercury	0	mg/L	1.88E+00	0.00E+00		0.00E+00		NC	NC	
	Selenium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Thallium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Vanadium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Zinc	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Chloroform	0.00131	mg/L	1.68E+00	4.45E-08		7.48E-08		NA	NA	
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	1.68E+00	6.81E-09		1.14E-08		6.30E+00	(mg/kg-day)-1	7.21E-08
	Methylene chloride	0.00804	mg/L	1.68E+00	1.31E-07		2.19E-07		7.50E-03	(mg/kg-day)-1	1.64E-09
	Benz(a)anthracene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/L	1.68E+00	0.00E+00		0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											1.59E-06
Grand Total											4.80E-05

TABLE C-21 Plow Shop Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.151	mg/L	2.39E-03			3.61E-04	mg/kg-day	3.00E-04	mg/kg/day	1.20E+00
	Barium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)		mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	5.97	mg/L	2.39E-03			1.43E-02	mg/kg-day	3.00E-01	mg/kg/day	4.75E-02
	Lead	0.000379	mg/L	2.39E-03			9.06E-07	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	2.39E-03			3.53E-04	mg/kg-day	2.40E-02	mg/kg/day	1.47E-02
	Manganese (in food)	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Selenium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Zinc	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0.00131	mg/L	2.39E-03			3.13E-06	mg/kg-day	1.00E-02	mg/kg/day	3.13E-04
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	2.39E-03			1.25E-07	mg/kg-day	5.00E-04	mg/kg/day	2.50E-04
	Methylene chloride	0.00804	mg/L	2.39E-03			1.92E-05	mg/kg-day	6.00E-02	mg/kg/day	3.20E-04
	Benz(a)anthracene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											1.26E+00

TABLE C-21 Plow Shop Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event		Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	0.151	mg/L	1.96E+01	6.04E-07		1.18E-05	mg/kg-day	3.00E-04	mg/kg-day	3.94E-02
	Barium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	1.40E-02	mg/kg-day	0.00E+00
	Cadmium (in solid media)	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	0.00E+00
	Cadmium (in water)			1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	3.90E-05	mg/kg-day	0.00E+00
	Copper	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	5.97	mg/L	1.96E+01	2.39E-05		4.68E-04	mg/kg-day	3.00E-01	mg/kg-day	1.56E-03
	Lead	0.000379	mg/L	1.96E+01	1.52E-09		2.97E-08	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	1.96E+01	5.92E-07		1.16E-05	mg/kg-day	9.60E-04	mg/kg-day	1.21E-02
	Manganese (in food)	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	3.00E-01	mg/kg-day	0.00E+00
	Chloroform	0.00131	mg/L	1.96E+01	4.45E-08		8.72E-07	mg/kg-day	1.00E-02	mg/kg-day	8.72E-05
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	1.96E+01	6.81E-09		1.33E-07	mg/kg-day	5.00E-04	mg/kg-day	2.67E-04
	Methylene chloride	0.00804	mg/L	1.96E+01	1.31E-07		2.56E-06	mg/kg-day	6.00E-02	mg/kg-day	4.26E-05
	Benz(a)anthracene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											5.35E-02
Grand Total											1.32E+00

Target organ across all exposure pathways: Central nervous system =	2.68E-02
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	1.24E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	5.17E-04
Target organ across all exposure pathways: Gastrointestinal System =	4.91E-02
Target organ across all exposure pathways: Immune system =	0.00E+00
Target organ across all exposure pathways: Liver =	7.63E-04
Target organ across all exposure pathways: Whole body/growth =	0.00E+00

TABLE C-22 PLOW SHOP POND
Recreational Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Antimony	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Arsenic	0.0796	mg/kg	5.46E-05			4.34E-06		1.50E+00	(mg/kg-day)-1	6.51E-06
	Barium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Copper	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Iron	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Lead	0	mg/kg	5.46E-05			0.00E+00		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Mercury	2.59	mg/kg	5.46E-05			1.41E-04		NC	NC	
	Selenium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Thallium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Vanadium	0.449	mg/kg	5.46E-05			2.45E-05		NC	NC	
	Zinc	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	5.46E-05			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	5.46E-05			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	5.46E-05			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	5.46E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	5.46E-05			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	5.46E-05			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	5.46E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	5.46E-05			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	5.46E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	5.46E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	5.46E-05			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	5.46E-05			1.02E-06		3.40E-01	(mg/kg-day)-1	3.47E-07
Total											6.86E-06
Grand Total											6.86E-06

TABLE C-22 PLOW SHOP POND
Recreational Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0796	mg/kg	6.37E-04			5.07E-05	mg/kg-day	3.00E-04	mg/kg/day	1.69E-01
	Barium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)			6.37E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	2.58	mg/kg	6.37E-04			1.65E-03	mg/kg-day	3.00E-04	mg/kg/day	5.50E+00
	Selenium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.449	mg/kg	6.37E-04			2.86E-04	mg/kg-day	1.00E-03	mg/kg/day	2.86E-01
	Zinc	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	6.37E-04			1.19E-05	mg/kg-day	2.00E-03	mg/kg/day	5.95E-03
Total											5.96E+00
Grand Total											5.96E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	1.69E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gastrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	5.50E+00
Target organ across all exposure pathways: Liver =	5.95E-03
Target organ across all exposure pathways: Whole body/growth =	2.86E-01

TABLE C-23 Plow Shop Pond
Subsistance Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Antimony	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Arsenic	0.0796	mg/kg	1.04E-03			8.27E-05		1.50E+00	(mg/kg-day)-1	1.24E-04
	Barium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Copper	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Iron	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Lead	0	mg/kg	1.04E-03			0.00E+00		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Mercury	2.59	mg/kg	1.04E-03			2.69E-03		NC	NC	
	Selenium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Thallium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Vanadium	0.449	mg/kg	1.04E-03			4.67E-04		NC	NC	
	Zinc	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.04E-03			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.04E-03			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.04E-03			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	1.04E-03			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	1.04E-03			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	1.04E-03			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	1.04E-03			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.04E-03			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.04E-03			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.04E-03			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	1.04E-03			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	1.04E-03			1.94E-05		3.40E-01	(mg/kg-day)-1	6.61E-06
Total											1.31E-04
Grand Total											1.31E-04

TABLE C-23 Plow Shop Pond
Subsistance Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0796	mg/kg	2.43E-03			1.93E-04	mg/kg-day	3.00E-04	mg/kg/day	6.44E-01
	Barium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)			2.43E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	2.58	mg/kg	2.43E-03			6.28E-03	mg/kg-day	3.00E-04	mg/kg/day	2.09E+01
	Selenium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.449	mg/kg	2.43E-03			1.09E-03	mg/kg-day	1.00E-03	mg/kg/day	1.09E+00
	Zinc	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	2.43E-03			4.54E-05	mg/kg-day	2.00E-03	mg/kg/day	2.27E-02
Total											2.27E+01
Grand Total											2.27E+01

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	6.44E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gastrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	2.09E+01
Target organ across all exposure pathways: Liver =	2.27E-02
Target organ across all exposure pathways: Whole body/growth =	1.09E+00

TABLE C- 24Plow Shop Pond
Subsistance Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Antimony	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Arsenic	0.0796	mg/kg	3.63E-04			2.89E-05		1.50E+00	(mg/kg-day)-1	4.34E-05
	Barium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Copper	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Iron	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Lead	0	mg/kg	3.63E-04			0.00E+00		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Mercury	2.59	mg/kg	3.63E-04			9.41E-04		NC	NC	
	Selenium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Thallium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Vanadium	0.449	mg/kg	3.63E-04			1.63E-04		NC	NC	
	Zinc	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	3.63E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	3.63E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	3.63E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	3.63E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	3.63E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	3.63E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	3.63E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	3.63E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	3.63E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	3.63E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	3.63E-04			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	3.63E-04			6.79E-06		3.40E-01	(mg/kg-day)-1	2.31E-06
Total											4.57E-05
Grand Total											4.57E-05

TABLE C- 24Plow Shop Pond
Subsistance Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0796	mg/kg	8.48E-04			6.75E-05	mg/kg-day	3.00E-04	mg/kg/day	2.25E-01
	Barium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)			8.48E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	2.59	mg/kg	8.48E-04			2.20E-03	mg/kg-day	3.00E-04	mg/kg/day	7.32E+00
	Selenium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.449	mg/kg	8.48E-04			3.81E-04	mg/kg-day	1.00E-03	mg/kg/day	3.81E-01
	Zinc	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	8.48E-04			1.59E-05	mg/kg-day	2.00E-03	mg/kg/day	7.93E-03
Total											7.93E+00
Grand Total											7.93E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	2.25E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gastrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	7.32E+00
Target organ across all exposure pathways: Liver =	7.93E-03
Target organ across all exposure pathways: Whole body/growth =	3.81E-01

TABLE C-25

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Near-shore Grove Pond Sediment	Aluminum	0.00E+00		0.00E+00	0.00E+00		5.19E-03		0.00E+00	5.19E-03
			Antimony	0.00E+00		0.00E+00	0.00E+00		7.61E-03		0.00E+00	7.61E-03
			Arsenic	2.60E-05		3.51E-05	6.11E-05		1.35E-01		1.82E-01	3.17E-01
			Barium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		1.24E-02		2.24E-02	3.48E-02
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		1.23E-02		0.00E+00	1.23E-02
			Copper	0.00E+00		0.00E+00	0.00E+00		5.50E-03		0.00E+00	5.50E-03
			Iron	0.00E+00		0.00E+00	0.00E+00		1.63E-02		0.00E+00	1.63E-02
			Lead	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		7.68E-03		0.00E+00	7.68E-03
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		8.05E-02		0.00E+00	8.05E-02
			Selenium	0.00E+00		0.00E+00	0.00E+00		4.99E-04		0.00E+00	4.99E-04
			Thallium	0.00E+00		0.00E+00	0.00E+00		1.02E-01		0.00E+00	1.02E-01
			Vanadium	0.00E+00		0.00E+00	0.00E+00		1.09E-02		0.00E+00	1.09E-02
			Zinc	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	5.47E-08		3.20E-07	3.75E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	5.83E-07		3.41E-06	4.00E-06		0.00E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	6.80E-08		3.98E-07	4.66E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	6.71E-09		3.93E-08	4.60E-08		0.00E+00		0.00E+00	0.00E+00
			Chrysene	8.80E-10		5.15E-09	6.03E-09		0.00E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	2.10E-07		1.23E-06	1.44E-06		0.00E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	5.13E-08		3.00E-07	3.51E-07		0.00E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		4.91E-05		2.87E-04	3.36E-04
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00

TABLE C-25

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Ingestion	Carcinogenic Risk Inhalation	Carcinogenic Risk Dermal	Carcinogenic Risk Exposure Routes Total	Primary Target Organ(s)	Non-Carcinogenic Hazard Quotient Ingestion	Non-Carcinogenic Hazard Quotient Inhalation	Non-Carcinogenic Hazard Quotient Dermal	Non-Carcinogenic Hazard Quotient Exposure Routes Total
			DDD, p,p'-	1.00E-08		1.35E-08	2.36E-08		4.87E-05		6.58E-05	1.15E-04
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	Exposure Medium Total						6.8E-05					6.0E-01
	Surface Water	Grove Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Antimony	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Arsenic	5.05E-06		2.26E-06	7.30E-06		3E-02		2.51E-02	5.12E-02
			Barium	0.00E+00		0.00E+00	0.00E+00		4E-03		4.90E-02	5.26E-02
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		3E-03		3.72E-01	3.75E-01
			Copper	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Iron	0.00E+00		0.00E+00	0.00E+00		2E-02		2.26E-02	4.62E-02
			Lead	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		1E-03		3.06E-02	3.20E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Selenium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Vanadium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Zinc	0.00E+00		0.00E+00	0.00E+00		2E-03		1.41E-03	3.86E-03
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chrysene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00

TABLE C-25

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Bis(2-ethylhexyl) phthalate	2.15E-08		1.36E-06	1.38E-06		2E-04		2.42E-02	2.44E-02
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
	Exposure Medium Total						8.7E-06					5.85E-01
Fish Tissue	Fish Tissue	Fish Tissue- Grove Pond	Aluminum	0.00E+00			0.00E+00		0E+00			0.00E+00
			Antimony	0.00E+00			0.00E+00		0E+00			0.00E+00
			Arsenic	0.00E+00			0.00E+00		0E+00			0.00E+00
			Barium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in solid media)	0.00E+00			0.00E+00		3E-02			2.68E-02
			Cadmium (in water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chromium, total	0.00E+00			0.00E+00		3E-02			3.38E-02
			Copper	0.00E+00			0.00E+00		0E+00			0.00E+00
			Iron	0.00E+00			0.00E+00		0E+00			0.00E+00
			Lead	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in sediment or water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in food)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Mercury	0.00E+00			0.00E+00		6E-01			6.03E-01
			Selenium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Thallium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Vanadium	0.00E+00			0.00E+00		3E-02			2.60E-02
			Zinc	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chloroform	0.00E+00			0.00E+00		0E+00			0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00		0E+00			0.00E+00
			Methylene chloride	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benz(a)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(a)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(b)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(k)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00

TABLE C-25

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chrysene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Dibenz(ah)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Naphthalene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCB 1254	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCBs, total	2.69E-05			2.69E-05		2E+00			1.57E+00
			DDD, p,p'-	7.61E-07			7.61E-07		4E-03			3.70E-03
			DDE, p,p'-	2.25E-06			2.25E-06		8E-03			7.72E-03
	Exposure Medium Total						3.0E-05					2.3E+00

Total Risk Across all Media	1.1E-04	Total Hazards Across all Media	3.5E+00

Target organ across all exposure pathways: Central nervous system =	4.5E-02
Target organ across all exposure pathways: Blood =	1.15E-02
Target organ across all exposure pathways: Skin =	3.68E-01
Target organ across all exposure pathways: Cardiovascular system =	5.26E-02
Target organ across all exposure pathways: Kidney =	6.16E-02
Target organ across all exposure pathways: Gatrointestinal System =	4.89E-01
Target organ across all exposure pathways: Immune system =	2.25E+00
Target organ across all exposure pathways: Liver =	1.38E-01
Target organ across all exposure pathways: Whole body/growth =	3.73E-02

TABLE C-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Near-shore Grove Pond Sediment	Aluminum	0.00E+00		0.00E+00	0.00E+00		4.85E-02		0.00E+00	4.85E-02
			Antimony	0.00E+00		0.00E+00	0.00E+00		7.10E-02		0.00E+00	7.10E-02
			Arsenic	4.85E-05		1.20E-05	6.05E-05		1.26E+00		3.11E-01	1.57E+00
			Barium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		1.16E-01		3.83E-02	1.54E-01
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		1.15E-01		0.00E+00	1.15E-01
			Copper	0.00E+00		0.00E+00	0.00E+00		5.13E-02		0.00E+00	5.13E-02
			Iron	0.00E+00		0.00E+00	0.00E+00		1.52E-01		0.00E+00	1.52E-01
			Lead	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		7.17E-02		0.00E+00	7.17E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		7.51E-01		0.00E+00	7.51E-01
			Selenium	0.00E+00		0.00E+00	0.00E+00		4.66E-03		0.00E+00	4.66E-03
			Thallium	0.00E+00		0.00E+00	0.00E+00		9.55E-01		0.00E+00	9.55E-01
			Vanadium	0.00E+00		0.00E+00	0.00E+00		1.02E-01		0.00E+00	1.02E-01
			Zinc	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	1.02E-07		0.00E+00	1.02E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	1.09E-06		1.17E-06	2.26E-06		0.00E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	1.27E-07		1.36E-07	2.63E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	1.25E-08		1.34E-08	2.60E-08		0.00E+00		0.00E+00	0.00E+00
			Chrysene	1.64E-09		1.76E-09	3.41E-09		0.00E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	3.93E-07		4.21E-07	8.14E-07		0.00E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	9.58E-08		1.03E-07	1.98E-07		0.00E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		4.58E-04		4.92E-04	9.50E-04
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00

TABLE C-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			DDD, p,p'-	1.87E-08		4.63E-09	2.33E-08		4.55E-04		1.13E-04	5.67E-04
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	Exposure Medium Total						6.4E-05					4.0E+00
	Surface Water	Grove Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Antimony	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Arsenic	2.35E-05		7.73E-07	2.43E-05		6E-01		2.00E-02	6.30E-01
			Barium	0.00E+00		0.00E+00	0.00E+00		8E-02		3.91E-02	1.23E-01
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		6E-02		2.97E-01	3.56E-01
			Copper	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Iron	0.00E+00		0.00E+00	0.00E+00		6E-01		1.81E-02	5.69E-01
			Lead	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		3E-02		2.38E-02	538E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Selenium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Vanadium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Zinc	0.00E+00		0.00E+00	0.00E+00		6E-02		1.13E-03	5.83E-02
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chrysene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00

TABLE C-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Bis(2-ethylhexyl) phthalate	1.00E-07		4.64E-07	5.64E-07		4E-03		1.93E-02	2.35E-02
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
	Exposure Medium Total						2.5E-0					1.85E+00
Fish Tissue	Fish Tissue	Fish Tissue- Grove Pond	Aluminum	0.00E+00			0.00E+00		0E+00			0.00E+00
			Antimony	0.00E+00			0.00E+00		0E+00			0.00E+00
			Arsenic	0.00E+00			0.00E+00		0E+00			0.00E+00
			Barium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in solid media)	0.00E+00			0.00E+00		5E-02			4.68E-02
			Cadmium (in water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chromium, total	0.00E+00			0.00E+00		6E-02			5.90E-02
			Copper	0.00E+00			0.00E+00		0E+00			0.00E+00
			Iron	0.00E+00			0.00E+00		0E+00			0.00E+00
			Lead	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in sediment or water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in food)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Mercury	0.00E+00			0.00E+00		1E+00			1.05E+00
			Selenium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Thallium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Vanadium	0.00E+00			0.00E+00		5E-02			4.55E-02
			Zinc	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chloroform	0.00E+00			0.00E+00		0E+00			0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00		0E+00			0.00E+00
			Methylene chloride	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benz(a)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(a)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(b)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(k)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00

TABLE C-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chrysene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Dibenz(ah)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Naphthalene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCB 1254	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCBs, total	9.38E-06			9.38E-06		3E+00			2.74E+00
			DDD, p,p'-	2.66E-07			2.66E-07		6E-03			6.46E-03
			DDE, p,p'-	7.87E-07			7.87E-07		1E-02			1.35E-02
	Exposure Medium Total						1.0E-05					4.0E+00

Total Risk Across all Media	1.0E-04	Total Hazards Across all Media	9.85E+00

Receptor HI Total

Target organ across all exposure pathways: Central nervous system =	1.79E-01
Target organ across all exposure pathways: Blood =	1.29E-01
Target organ across all exposure pathways: Skin =	2.20E+00
Target organ across all exposure pathways: Cardiovascular system =	1.23E-01
Target organ across all exposure pathways: Kidney =	2.01E-01
Target organ across all exposure pathways: Gatrointestinal System =	1.30E+00
Target organ across all exposure pathways: Immune system =	4.54E+00
Target organ across all exposure pathways: Liver =	9.99E-01
Target organ across all exposure pathways: Whole body/growth =	1.48E-01

TABLE C-27

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Near-shore Plow Shop Pond	Aluminum	0.00E+00		0.00E+00	0.00E+00		2.47E-03		0.00E+00	2.47E-03
			Antimony	0.00E+00		0.00E+00	0.00E+00		1.09E-02		0.00E+00	1.09E-02
			Arsenic	1.53E-04		2.06E-04	3.59E-04		7.93E-01		1.07E+00	1.86E+00
			Barium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		3.91E-03		7.04E-03	1.10E-02
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		1.04E+00		0.00E+00	1.04E+00
			Copper	0.00E+00		0.00E+00	0.00E+00		2.05E-03		0.00E+00	2.05E-03
			Iron	0.00E+00		0.00E+00	0.00E+00		8.21E-02		0.00E+00	8.21E-02
			Lead	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		3.22E-02		0.00E+00	3.22E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		2.96E-02		0.00E+00	2.96E-02
			Selenium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		5.19E-02		0.00E+00	5.19E-02
			Vanadium	0.00E+00		0.00E+00	0.00E+00		8.11E-03		0.00E+00	8.11E-03
			Zinc	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	2.92E-07		0.00E+00	2.92E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	3.74E-06		2.19E-05	2.56E-05		0.00E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	3.12E-07		1.83E-06	2.14E-06		0.00E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	1.15E-08		6.74E-08	7.89E-08		0.00E+00		0.00E+00	0.00E+00
			Chrysene	3.43E-09		2.00E-08	2.35E-08		0.00E+00		0.00E+00	0.00E+00
			Dibenz(a,h)anthracene	7.68E-07		4.49E-06	5.26E-06		0.00E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	2.90E-07		1.71E-06	2.01E-06		0.00E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00

TABLE C-27

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk: Ingestion	Carcinogenic Risk: Inhalation	Carcinogenic Risk: Dermal	Carcinogenic Risk: Exposure Routes Total	Non-Carcinogenic Hazard Quotient: Primary Target Organ(s)	Non-Carcinogenic Hazard Quotient: Ingestion	Non-Carcinogenic Hazard Quotient: Inhalation	Non-Carcinogenic Hazard Quotient: Dermal	Non-Carcinogenic Hazard Quotient: Exposure Routes Total
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	Exposure Medium Total						3.9E-04					3.1E+00
	Surface Water	Plow Shop Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Antimony	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Arsenic	9.93E-06		4.45E-06	1.44E-05		5E-02		4.94E-02	1.01E-01
			Barium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Copper	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Iron	0.00E+00		0.00E+00	0.00E+00		2E-03		1.95E-03	3.95E-03
			Lead	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		6E-04		1.51E-02	1.58E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Selenium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Vanadium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Zinc	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		1E-05		1.09E-04	1.23E-04
			Hexachlorocyclohexane, alpha-	1.45E-08		2.11E-07	2.25E-07		1E-05		3.34E-04	3.45E-04
			Methylene chloride	2.84E-09		4.60E-09	7.45E-09		1E-05		6.34E-05	6.71E-05
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chrysene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Dibenz(a,h)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00

TABLE C-27

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
	Exposure Medium Total						1.5E-05					1.2E-01
Fish Tissue	Fish Tissue	Fish Tissue- Plow Shop Pond	Aluminum	0.00E+00			0.00E+00		0E+00			0.00E+00
			Antimony	0.00E+00			0.00E+00		0E+00			0.00E+00
			Arsenic	1.86E-05			1.86E-05		1E-01			9.67E-02
			Barium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in solid media)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chromium, total	0.00E+00			0.00E+00		0E+00			0.00E+00
			Copper	0.00E+00			0.00E+00		0E+00			0.00E+00
			Iron	0.00E+00			0.00E+00		0E+00			0.00E+00
			Lead	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in sediment or water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in food)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Mercury	0.00E+00			0.00E+00		3E+00			3.14E+00
			Selenium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Thallium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Vanadium	0.00E+00			0.00E+00		2E-01			1.94E-01
			Zinc	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chloroform	0.00E+00			0.00E+00		0E+00			0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00		0E+00			0.00E+00
			Methylene chloride	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benz(a)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(a)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(b)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(k)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chrysene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Dibenz(a,h)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Naphthalene	0.00E+00			0.00E+00		0E+00			0.00E+00

TABLE C-27

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCB 1254	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCBs, total	0.00E+00			0.00E+00		0E+00			0.00E+00
			DDD, p,p'-	0.00E+00			0.00E+00		0E+00			0.00E+00
			DDE, p,p'-	9.83E-07			9.83E-07		3E-03			3.41E-03
	Exposure Medium Total						2.0E-05					3.4E+00

Total Risk Across all Media	4.3E-04	Total Hazards Across all Media	6.7E+00

Receptor HI Total

Target organ across all exposure pathways: Central nervous system =	5.04E-02
Target organ across all exposure pathways: Blood =	1.09E-02
Target organ across all exposure pathways: Skin =	2.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.13E-03
Target organ across all exposure pathways: Gastrointestinal System =	1.13E+00
Target organ across all exposure pathways: Immune system =	3.17E+00
Target organ across all exposure pathways: Liver =	5.55E-02
Target organ across all exposure pathways: Whole body/growth =	1.73E-01

TABLE C-28

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Near-shore Plow Shop Pond	Aluminum	0.00E+00		0.00E+00	0.00E+00		2.31E-02		0.00E+00	2.31E-02
			Antimony	0.00E+00		0.00E+00	0.00E+00		1.02E-01		0.00E+00	1.02E-01
			Arsenic	2.85E-04		7.07E-05	3.56E-04		7.40E+00		1.83E+00	9.23E+00
			Barium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		3.65E-02		1.21E-02	4.86E-02
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		9.71E+00		0.00E+00	9.71E+00
			Copper	0.00E+00		0.00E+00	0.00E+00		1.92E-02		0.00E+00	1.92E-02
			Iron	0.00E+00		0.00E+00	0.00E+00		7.60E-01		0.00E+00	7.60E-01
			Lead	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		3.00E-01		0.00E+00	3.00E-01
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		2.76E-01		0.00E+00	2.76E-01
			Selenium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		4.85E-01		0.00E+00	4.85E-01
			Vanadium	0.00E+00		0.00E+00	0.00E+00		8.50E-02		0.00E+00	8.50E-02
			Zinc	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chlordane	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	5.45E-07		0.00E+00	5.45E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	6.98E-06		7.48E-06	1.45E-05		0.00E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	5.83E-07		6.25E-07	1.21E-06		0.00E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	2.15E-08		2.31E-08	4.46E-08		0.00E+00		0.00E+00	0.00E+00
			Chrysene	6.39E-09		6.86E-09	1.33E-08		0.00E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	1.43E-06		1.54E-06	2.97E-06		0.00E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	5.47E-07		5.86E-07	1.13E-06		0.00E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00

TABLE C-28

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	Exposure Medium Total						3.5E-04					2.1E+01
	Surface Water	Plow Shop Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Antimony	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Arsenic	4.94E-05		1.52E-06	4.79E-05		1E+00		3.94E-02	1.24E+00
			Barium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Copper	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Iron	0.00E+00		0.00E+00	0.00E+00		5E-02		1.58E-03	4.91E-02
			Lead	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		1E-02		1.21E-02	2.68E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Selenium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Vanadium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Zinc	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		3E-04		8.72E-05	4.00E-04
			Hexachlorocyclohexane, alpha-	6.78E-08		7.21E-08	1.40E-07		3E-04		2.67E-04	5.17E-04
			Methylene chloride	1.23E-08		1.64E-09	1.40E-08		3E-04		4.26E-05	3.63E-04
			Benzo(a)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chrysene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Dibenz(a,h)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00

TABLE C-28

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
	Exposure Medium Total						4.8E-05					1.3E+00
Fish Tissue	Fish Tissue	Fish Tissue- Plow Shop Pond	Aluminum	0.00E+00			0.00E+00		0E+00			0.00E+00
			Antimony	0.00E+00			0.00E+00		0E+00			0.00E+00
			Arsenic	6.51E-06			6.51E-06		2E-01			1.89E-01
			Barium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in solid media)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chromium, total	0.00E+00			0.00E+00		0E+00			0.00E+00
			Copper	0.00E+00			0.00E+00		0E+00			0.00E+00
			Iron	0.00E+00			0.00E+00		0E+00			0.00E+00
			Lead	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in sediment or water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in food)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Mercury	0.00E+00			0.00E+00		5E+00			5.30E+00
			Selenium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Thallium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Vanadium	0.00E+00			0.00E+00		3E-01			2.80E-01
			Zinc	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chloroform	0.00E+00			0.00E+00		0E+00			0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00		0E+00			0.00E+00
			Methylene chloride	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benz(a)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(a)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(b)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(k)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00

TABLE C-28

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chrysene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Dibenzo(a,h)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Naphthalene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCB 1254	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCBs, total	0.00E+00			0.00E+00		0E+00			0.00E+00
			DDD, p,p'-	0.00E+00			0.00E+00		0E+00			0.00E+00
			DDE, p,p'-	3.47E-07			3.47E-07		6E-03			5.95E-03
	Exposure Medium Total						6.9E-06					6.0E+00

Total Risk Across all Media	4.3E-04	Total Hazards Across all Media	2.8E+01

Target organ across all exposure pathways: Central nervous system =	3.2E-01
Target organ across all exposure pathways: Blood =	1.0E-01
Target organ across all exposure pathways: Skin =	8.2E+00
Target organ across all exposure pathways: Cardiovascular system =	8.0E+00
Target organ across all exposure pathways: Kidney =	4.9E-02
Target organ across all exposure pathways: Gastrointestinal System =	1.0E+01
Target organ across all exposure pathways: Immune system =	2.8E-01
Target organ across all exposure pathways: Liver =	4.8E-01
Target organ across all exposure pathways: Whole body/growth =	8.5E-03

TABLE C-29

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Sediment	Sediment	Near-shore Grove Pond Sediment	Aluminum	0.00E+00		0.00E+00	0.00E+00	_		5.19E-03		0.00E+00	5.19E-03	_
			Antimony	0.00E+00		0.00E+00	0.00E+00	_		7.61E-03		0.00E+00	7.61E-03	_
			Arsenic	2.60E-05		3.51E-05	6.11E-05	Yes		1.35E-01		1.82E-01	3.17E-01	_
			Barium	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	_		1.24E-02		2.24E-02	3.48E-02	_
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	_		1.23E-02		0.00E+00	1.23E-02	_
			Copper	0.00E+00		0.00E+00	0.00E+00	_		5.50E-03		0.00E+00	5.50E-03	_
			Iron	0.00E+00		0.00E+00	0.00E+00	_		1.63E-02		0.00E+00	1.63E-02	_
			Lead	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	_		7.68E-03		0.00E+00	7.68E-03	_
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Mercury	0.00E+00		0.00E+00	0.00E+00	_		8.05E-02		0.00E+00	8.05E-02	_
			Selenium	0.00E+00		0.00E+00	0.00E+00	_		4.99E-04		0.00E+00	4.99E-04	_
			Thallium	0.00E+00		0.00E+00	0.00E+00	_		1.02E-01		0.00E+00	1.02E-01	_
			Vanadium	0.00E+00		0.00E+00	0.00E+00	_		1.09E-02		0.00E+00	1.09E-02	_
			Zinc	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Chloroform	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Benz(a)anthracene	5.47E-08		3.20E-07	3.75E-07	_		0.00E+00		0.00E+00	0.00E+00	_
			Benzo(a)pyrene	5.83E-07		3.41E-06	4.00E-06	Yes		0.00E+00		0.00E+00	0.00E+00	_
			Benzo(b)fluoranthene	6.80E-08		3.98E-07	4.66E-07	_		0.00E+00		0.00E+00	0.00E+00	_
			Benzo(k)fluoranthene	6.71E-09		3.93E-08	4.60E-08	_		0.00E+00		0.00E+00	0.00E+00	_
			Chrysene	8.80E-10		5.15E-09	6.03E-09	_		0.00E+00		0.00E+00	0.00E+00	_
			Dibenz(ah)anthracene	2.10E-07		1.23E-06	1.44E-06	Yes		0.00E+00		0.00E+00	0.00E+00	_
			Indeno(1,2,3-cd)pyrene	5.13E-08		3.00E-07	3.51E-07	_		0.00E+00		0.00E+00	0.00E+00	_
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	_		4.91E-05		2.87E-04	3.36E-04	_
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			DDD, p,p'-	1.00E-08		1.35E-08	2.36E-08	_		4.87E-05		6.58E-05	1.15E-04	_
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
	Exposure Medium Total						6.8E-05	Yes					6.0E-01	_

TABLE C-29
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
	Surface Water	Grove Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Antimony	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Arsenic	5.05E-06		2.26E-06	7.30E-06	Yes		3E-02		2.51E-02	5.12E-02	_
			Barium	0.00E+00		0.00E+00	0.00E+00	_		4E-03		4.90E-02	5.26E-02	_
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	_		3E-03		3.72E-01	3.75E-01	_
			Copper	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Iron	0.00E+00		0.00E+00	0.00E+00	_		2E-02		2.26E-02	4.62E-02	_
			Lead	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	_		1.34E-03		3.06E-02	3.19E-02	_
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Mercury	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Selenium	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Thallium	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Vanadium	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Zinc	0.00E+00		0.00E+00	0.00E+00	_		2E-03		1.41E-03	3.86E-03	_
			Chloroform	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Chrysene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Bis(2-ethylhexyl) phthalate	2.15E-08		1.36E-06	1.38E-06	Yes		2E-04		2.42E-02	2.44E-02	_
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
	Exposure Medium Total						8.7E-06	Yes					5.85E-01	_

TABLE C-29
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish Tissue	Fish Tissue	Fish Tissue- Grove Pond	Aluminum	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Antimony	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Arsenic	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Barium	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Cadmium (in solid media)	0.00E+00			0.00E+00	_		3E-02			2.68E-02	_
			Cadmium (in water)	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Chromium, total	0.00E+00			0.00E+00	_		3E-02			3.38E-02	_
			Copper	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Iron	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Lead	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Manganese (in sediment or water)	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Manganese (in food)	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Mercury	0.00E+00			0.00E+00	_		6E-01			6.03E-01	_
			Selenium	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Thallium	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Vanadium	0.00E+00			0.00E+00	_		3E-02			2.60E-02	_
			Zinc	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Chloroform	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Methylene chloride	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Benz(a)anthracene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Benzo(a)pyrene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Chrysene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Naphthalene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			PCB 1254	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			PCBs, total	2.69E-05			2.69E-05	Yes		2E+00			1.57E+00	Yes
			DDD, p,p'-	7.61E-07			7.61E-07	_		4E-03			3.70E-03	_
			DDE, p,p'-	2.25E-06			2.25E-06	Yes		8E-03			7.72E-03	_
	Exposure Medium Total						3.0E-05	Yes					2.3E+00	Yes

TABLE C-29

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1

Target organ across all exposure pathways: Central nervous system =	4.5E-02
Target organ across all exposure pathways: Blood =	1.1E-02
Target organ across all exposure pathways: Skin =	3.7E-01
Target organ across all exposure pathways: Cardiovascular system =	5.3E-02
Target organ across all exposure pathways: Kidney =	6.2E-02
Target organ across all exposure pathways: Gatrointestinal System =	4.9E-01
Target organ across all exposure pathways: Immune system =	2.3E+00
Target organ across all exposure pathways: Liver =	1.4E-01
Target organ across all exposure pathways: Whole body/growth =	3.7E-02

TABLE C-30

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Sediment	Sediment	Near-shore Grove Pond Sediment	Aluminum	0.00E+00		0.00E+00	0.00E+00	_		4.85E-02		0.00E+00	4.85E-02	_
			Antimony	0.00E+00		0.00E+00	0.00E+00	_		7.10E-02		0.00E+00	7.10E-02	_
			Arsenic	4.85E-05		1.20E-05	6.05E-05	Yes		1.26E+00		3.11E-01	1.57E+00	Yes
			Barium	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	_		1.16E-01		3.83E-02	1.54E-01	_
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	_		1.15E-01		0.00E+00	1.15E-01	_
			Copper	0.00E+00		0.00E+00	0.00E+00	_		5.13E-02		0.00E+00	5.13E-02	_
			Iron	0.00E+00		0.00E+00	0.00E+00	_		1.52E-01		0.00E+00	1.52E-01	_
			Lead	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	_		7.17E-02		0.00E+00	7.17E-02	_
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Mercury	0.00E+00		0.00E+00	0.00E+00	_		7.51E-01		0.00E+00	7.51E-01	_
			Selenium	0.00E+00		0.00E+00	0.00E+00	_		4.66E-03		0.00E+00	4.66E-03	_
			Thallium	0.00E+00		0.00E+00	0.00E+00	_		9.55E-01		0.00E+00	9.55E-01	_
			Vanadium	0.00E+00		0.00E+00	0.00E+00	_		1.02E-01		0.00E+00	1.02E-01	_
			Zinc	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Chloroform	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			Benz(a)anthracene	1.02E-07		0.00E+00	1.02E-07	_		0.00E+00		0.00E+00	0.00E+00	_
			Benzo(a)pyrene	1.09E-06		1.17E-06	2.26E-06	Yes		0.00E+00		0.00E+00	0.00E+00	_
			Benzo(b)fluoranthene	1.27E-07		1.36E-07	2.63E-07	_		0.00E+00		0.00E+00	0.00E+00	_
			Benzo(k)fluoranthene	1.25E-08		1.34E-08	2.60E-08	_		0.00E+00		0.00E+00	0.00E+00	_
			Chrysene	1.64E-09		1.76E-09	3.41E-09	_		0.00E+00		0.00E+00	0.00E+00	_
			Dibenz(ah)anthracene	3.93E-07		4.21E-07	8.14E-07	_		0.00E+00		0.00E+00	0.00E+00	_
			Indeno(1,2,3-cd)pyrene	9.58E-08		1.03E-07	1.98E-07	_		0.00E+00		0.00E+00	0.00E+00	_
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	_		4.58E-04		4.92E-04	9.50E-04	_
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
			DDD, p,p'-	1.87E-08		4.63E-09	2.33E-08	_		4.55E-04		1.13E-04	5.67E-04	_
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	_		0.00E+00		0.00E+00	0.00E+00	_
	Exposure Medium Total						6.4E-05	Yes					4.0E+00	Yes

TABLE C-30
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
	Surface Water	Grove Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Antimony	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Arsenic	2.35E-05		7.73E-07	2.43E-05	Yes		6E-01		2.00E-02	6.30E-01	_
			Barium	0.00E+00		0.00E+00	0.00E+00	_		8E-02		3.91E-02	1.23E-01	_
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	_		6E-02		2.97E-01	3.56E-01	_
			Copper	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Iron	0.00E+00		0.00E+00	0.00E+00	_		6E-01		1.81E-02	5.69E-01	_
			Lead	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	_		3E-02		2.38E-02	5.38E-02	_
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Mercury	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Selenium	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Thallium	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Vanadium	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Zinc	0.00E+00		0.00E+00	0.00E+00	_		6E-02		1.13E-03	5.83E-02	_
			Chloroform	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Chrysene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			Bis(2-ethylhexyl) phthalate	1.00E-07		4.64E-07	5.64E-07	_		4E-03		1.93E-02	2.35E-02	_
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	_		0E+00		0.00E+00	0.00E+00	_
	Exposure Medium Total						2.5E-05	Yes					1.85E+00	_

TABLE C-30

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish Tissue	Fish Tissue	Fish Tissue- Grove Pond	Aluminum	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Antimony	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Arsenic	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Barium	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Cadmium (in solid media)	0.00E+00			0.00E+00	_		5E-02			4.68E-02	_
			Cadmium (in water)	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Chromium, total	0.00E+00			0.00E+00	_		6E-02			5.90E-02	_
			Copper	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Iron	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Lead	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Manganese (in sediment or water)	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Manganese (in food)	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Mercury	0.00E+00			0.00E+00	_		1E+00			1.05E+00	Yes
			Selenium	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Thallium	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Vanadium	0.00E+00			0.00E+00	_		5E-02			4.55E-02	_
			Zinc	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Chloroform	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Methylene chloride	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Benz(a)anthracene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Benzo(a)pyrene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Chrysene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Naphthalene	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			PCB 1254	0.00E+00			0.00E+00	_		0E+00			0.00E+00	_
			PCBs, total	9.38E-06			9.38E-06	Yes		3E+00			2.74E+00	Yes
			DDD, p,p'-	2.66E-07			2.66E-07	_		6E-03			6.46E-03	_
			DDE, p,p'-	7.87E-07			7.87E-07	_		1E-02			1.35E-02	_
	Exposure Medium Total						1.0E-05	Yes					4.0E+00	Yes

TABLE C-30
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1

Target organ across all exposure pathways: Central nervous system =	1.79E-01
Target organ across all exposure pathways: Blood =	1.29E-01
Target organ across all exposure pathways: Skin =	2.20E+00
Target organ across all exposure pathways: Cardiovascular system =	1.23E-01
Target organ across all exposure pathways: Kidney =	2.01E-01
Target organ across all exposure pathways: Gatrointestinal System =	1.30E+00
Target organ across all exposure pathways: Immune system =	4.54E+00
Target organ across all exposure pathways: Liver =	9.99E-01
Target organ across all exposure pathways: Whole body/growth =	1.48E-01

TABLE C-31

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Subsistence
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish	Fish fillet	Grove Pond	Aluminum	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Antimony	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Arsenic	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Barium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Cadmium (in solid media)	0.00E+00			0.00E+00	--		1.70E-01			1.70E-01	--
			Cadmium (in water)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Chromium, total	0.00E+00			0.00E+00	--		2.25E-01			2.25E-01	--
			Copper	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Iron	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Lead	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Manganese (in sediment or water)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Manganese (in food)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Mercury	0.00E+00			0.00E+00	--		4.02E+00			4.02E+00	Yes
			Selenium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Thallium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Vanadium	0.00E+00			0.00E+00	--		1.73E-01			1.73E-01	--
			Zinc	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Chloroform	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Methylene chloride	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(a)anthracene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(a)pyrene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Chrysene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Naphthalene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			PCB 1254	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			PCBs, total	1.70E-04			1.70E-04	Yes		1.04E+01			1.04E+01	Yes
			DDD, p,p'	5.06E-06			5.06E-06	Yes		2.49E-02			2.49E-02	--
			DDE, p,p'	1.50E-05			1.50E-05	Yes		5.14E-02			5.14E-02	--
	Exposure Medium Total						2.0E-04	Yes					1.5E+01	Yes

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.70E-01
Target organ across all exposure pathways: Gastrointestinal System =	2.25E-01
Target organ across all exposure pathways: Immune system =	1.44E+01
Target organ across all exposure pathways: Liver =	7.80E-02
Target organ across all exposure pathways: Whole body/growth =	1.73E-01

TABLE C-32
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Subsistence
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish	Fish Diet	Grove Pond	Aluminum	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Arsenic	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Barium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		1.79E-01			8.24E-02	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		2.25E-01			7.86E-02	–
			Copper	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in sediment or water)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		4.02E+00			1.40E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		1.73E-01			6.00E-02	–
			Zinc	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benz(a)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCBs, total	8.25E-05			8.25E-05	Yes		1.04E+01			3.64E+00	Yes
			DDD, p,p'-	1.77E-06			1.77E-06	Yes		2.46E-02			8.60E-03	–
			DDE, p,p'-	5.24E-06			5.24E-06	Yes		5.14E-02			1.80E-02	–
	Exposure Medium Total						8.9E-05	Yes					5.3E+00	Yes

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	8.24E-02
Target organ across all exposure pathways: Gastrointestinal System =	7.86E-02
Target organ across all exposure pathways: Immune system =	[illegible]
Target organ across all exposure pathways: Liver =	2.66E-02
Target organ across all exposure pathways: Whole body/growth =	6.00E-02

TABLE C-33
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Sediment	Sediment	Near-shore Plow Shop Pond	Aluminum	0.00E+00		0.00E+00	0.00E+00	--		2.47E-03		0.00E+00	2.47E-03	--
			Antimony	0.00E+00		0.00E+00	0.00E+00	--		1.09E-02		0.00E+00	1.09E-02	--
			Arsenic	1.63E-04		2.08E-04	3.70E-04	Yes		7.93E-01		1.07E+00	1.86E+00	Yes
			Barium	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	--		3.91E-03		7.84E-03	1.18E-02	--
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	--		1.64E+00		0.00E+00	1.64E+00	Yes
			Copper	0.00E+00		0.00E+00	0.00E+00	--		2.85E-03		0.00E+00	2.85E-03	--
			Iron	0.00E+00		0.00E+00	0.00E+00	--		8.21E-02		0.00E+00	8.21E-02	--
			Lead	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	--		3.22E-02		0.00E+00	3.22E-02	--
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Mercury	0.00E+00		0.00E+00	0.00E+00	--		2.96E-02		0.00E+00	2.96E-02	--
			Selenium	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Thallium	0.00E+00		0.00E+00	0.00E+00	--		5.19E-02		0.00E+00	5.19E-02	--
			Vanadium	0.00E+00		0.00E+00	0.00E+00	--		9.11E-03		0.00E+00	9.11E-03	--
			Zinc	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Chloroform	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Benzo(a)anthracene	2.50E-07		0.00E+00	2.50E-07	--		0.00E+00		0.00E+00	0.00E+00	--
			Benzo(a)pyrene	3.74E-06		2.19E-05	2.56E-05	Yes		0.00E+00		0.00E+00	0.00E+00	--
			Benzo(b)fluoranthene	3.12E-07		1.83E-06	2.14E-06	Yes		0.00E+00		0.00E+00	0.00E+00	--
			Benzo(k)fluoranthene	1.11E-08		6.74E-08	7.85E-08	--		0.00E+00		0.00E+00	0.00E+00	--
			Chrysene	3.43E-09		2.09E-08	2.39E-08	--		0.00E+00		0.00E+00	0.00E+00	--
			Dibenz(a,h)anthracene	7.50E-07		4.48E-06	5.28E-06	Yes		0.00E+00		0.00E+00	0.00E+00	--
			Indeno(1,2,3-cd)pyrene	2.93E-07		1.71E-06	2.01E-06	Yes		0.00E+00		0.00E+00	0.00E+00	--
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Bis(2-ethylhexyl)phthalate	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
	Exposure Medium Total						3.9E-04	Yes					3.1E+00	Yes

TABLE C-33
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, FLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
	Surface Water	Flow Shop Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Antimony	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Arsenic	9.93E-06		4.46E-05	1.44E-05	Yes		3E-02		4.34E-02	1.01E-01	--
			Barium	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Copper	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Iron	0.00E+00		0.00E+00	0.00E+00	--		2E-03		1.99E-03	3.99E-03	--
			Lead	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Manganese (in sed/food or water)	0.00E+00		0.00E+00	0.00E+00	--		4E-04		1.51E-02	1.56E-02	--
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Mercury	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Selenium	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Thallium	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Vanadium	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Zinc	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Chlordane	0.00E+00		0.00E+00	0.00E+00	--		1E-05		1.09E-04	1.23E-04	--
			Hexachlorocyclohexane, alpha-	1.45E-08		2.11E-07	2.25E-07	--		1E-06		3.34E-04	3.45E-04	--
			Methylene chloride	2.84E-09		4.90E-09	7.45E-09	--		1E-05		5.34E-05	6.21E-05	--
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Chrysene	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Dibenz(a,h)anthracene	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	--		0E+00		0.00E+00	0.00E+00	--
	Exposure Medium Total						1.7E-05	Yes					1.2E-01	

TABLE C-33

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Total Risk Across all Media 1.07E-04

Total Hazards Across all Media 3.49E+00

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish Tissue	Fish Tissue	Fish Tissue: Plow Shop Pond	Aluminum	[illegible]			[illegible]	–		[illegible]			[illegible]	–
			Antimony	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Arsenic	1.40E-05			1.05E-05	Yes		1E-01			9.67E-02	–
			Barium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Copper	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in sediment or water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		3E+00			3.14E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		[illegible]			[illegible]	–
			Thallium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		2E-01			1.64E-01	–
			Zinc	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chlordane	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benz(a)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Dibenz(a,h)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCBs, total	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			DDD, p,p'-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			DDE, p,p'-	[illegible]			[illegible]	–		3E-03			3.41E-03	–
	Exposure Medium Total						[illegible]	Yes					[illegible]	Yes

TABLE C-33
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1

Total Risk Across all Media: 4.3E-04

Total Hazards Across all Media: 6.7E+00

Target organ across all exposure pathways: Central nervous system =	5.04E-02
Target organ across all exposure pathways: Blood =	1.39E-02
Target organ across all exposure pathways: Skin =	2.89E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.10E-02
Target organ across all exposure pathways: Gastrointestinal System =	1.18E+00
Target organ across all exposure pathways: Immune system =	3.17E+00
Target organ across all exposure pathways: Liver =	5.50E-02
Target organ across all exposure pathways: Whole body/growth =	1.73E-01

TABLE C-34

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Sediment	Sediment	Near-shore Plow Shop Pond	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		2.31E-02		0.00E+00	2.31E-02	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		1.82E-01		0.00E+00	1.82E-01	–
			Arsenic	2.85E-04		7.07E-05	3.56E-04	Yes		7.40E+00		1.83E+00	9.23E+00	Yes
			Barium	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		3.65E-02		1.21E-02	4.86E-02	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		9.71E+00		0.00E+00	9.71E+00	Yes
			Copper	0.00E+00		0.00E+00	0.00E+00	–		1.92E-02		0.00E+00	1.92E-02	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		7.66E-01		0.00E+00	7.66E-01	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		3.06E-01		0.00E+00	3.06E-01	–
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		2.70E-01		0.00E+00	2.70E-01	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		4.65E-01		0.00E+00	4.65E-01	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		8.50E-02		0.00E+00	8.50E-02	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Chlordane	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Benz(a)anthracene	5.45E-07		0.00E+00	5.45E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	6.98E-06		7.48E-06	1.45E-05	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	5.83E-07		6.25E-07	1.21E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	2.15E-08		2.31E-08	4.46E-08	–		0.00E+00		0.00E+00	0.00E+00	–
			Chrysene	6.39E-09		6.86E-09	1.33E-08	–		0.00E+00		0.00E+00	0.00E+00	–
			Dibenz(a,h)anthracene	1.40E-06		1.34E-06	2.97E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	5.47E-07		5.86E-07	1.13E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						3.8E-04	Yes					2.1E+01	Yes

TABLE C-34

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
	Surface Water	Plow Shop Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Arsenic	4.64E-05		1.52E-06	4.79E-05	Yes		1E+00		3.94E-02	1.24E+00	Yes
			Barium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Copper	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		5E-02		1.86E-03	4.91E-02	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		1E-02		1.21E-02	2.58E-02	–
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chloroform	0.00E+00		0.00E+00	0.00E+00	–		3E-04		8.72E-05	4.02E-04	–
			Hexachlorocyclohexane, alpha-	6.79E-08		7.21E-08	1.40E-07	–		3E-04		2.07E-04	5.17E-04	–
			Methylene chloride	1.23E-08		1.64E-09	1.40E-08	–		3E-04		4.29E-05	3.63E-04	–
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chrysene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Dibenz(a,h)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						4.8E-05	Yes					1.3E+00	Yes

TABLE C-34
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Total Risk Across all Media 9.90E-05

Total Hazards Across all Media 9.85E+00

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish Tissue	Fish Tissue	Fish Tissue - Plow Shop Pond	Aluminum	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Arsenic	6.51E-06			6.51E-06	Yes		2E-01			1.00E-01	–
			Barium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Copper	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in sediment or water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		[illegible]			[illegible]	Yes
			Selenium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		7E-01			2.00E-01	–
			Zinc	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benz(a)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Dibenz(a,h)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCBs, total	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			DDD, p,p'-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			DDE, p,p'-	3.47E-07			3.47E-07	–		6E-03			[illegible]	–
	Exposure Medium Total						[illegible]	Yes					[illegible]	Yes

TABLE C-34

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-4	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1

Total Risk Across all Media: 4.3E-04

Total Hazards Across all Media: 2.5E+01

Target organ across all exposure pathways: Central nervous system =	3.22E-01
Target organ across all exposure pathways: Blood =	1.02E-01
Target organ across all exposure pathways: Skin =	9.23E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	4.90E-02
Target organ across all exposure pathways: Gastrointestinal System =	1.05E+01
Target organ across all exposure pathways: Immune system =	2.76E-01
Target organ across all exposure pathways: Liver =	4.85E-01
Target organ across all exposure pathways: Whole body/growth =	6.50E-02

TABLE C-35

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Subsistence
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish	Fish Diet	Plow Shop Pond	Aluminum	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Antimony	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Arsenic	1.24E-04			1.24E-04	Yes		6.44E-01			6.44E-01	--
			Barium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Cadmium (in solid media)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Cadmium (in water)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Chromium, total	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Copper	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Iron	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Lead	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Manganese (in sediment or water)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Manganese (in food)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Mercury	0.00E+00			0.00E+00	--		2.09E+01			2.09E+01	Yes
			Selenium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Thallium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Vanadium	0.00E+00			0.00E+00	--		1.88E+00			1.88E+00	Yes
			Zinc	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Chlordane	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Methylene chloride	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(a)anthracene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(a)pyrene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Chrysene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Dibenz(a,h)anthracene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Naphthalene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			PCB 1254	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			PCBs, total	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			DDD, p,p'-	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			DDE, p,p'-	8.61E-06			8.61E-06	Yes		2.27E-02			2.27E-02	--
	Exposure Medium Total						1.3E-04	Yes					2.1E+01	Yes

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	6.44E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gastrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	2.09E+01
Target organ across all exposure pathways: Liver =	2.27E-02
Target organ across all exposure pathways: Whole body/growth =	1.88E+00

TABLE C-36

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, FLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Subsistence
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish	Fish Mat	Flow Shop Pond	Aluminum	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Arsenic	4.34E-05			4.34E-05	Yes		2.25E-01			2.25E-01	–
			Barium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Copper	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in sediment or wate	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		7.32E+00			7.32E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Zinc	0.00E+00			0.00E+00	–		3.81E-01			3.81E-01	–
			Chlordane	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(a)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Dibenz(a,h)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCBs, total	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			DDD, p,p'-	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			DDE, p,p'-	2.31E-06			2.31E-06	Yes		7.93E-03			7.93E-03	–
	Exposure Medium Total						4.6E-05	Yes					7.9E+00	Yes

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	2.25E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gastrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	7.32E+00
Target organ across all exposure pathways: Liver =	7.93E-03
Target organ across all exposure pathways: Whole body/growth =	3.81E-01

APPENDIX D

TABLE D-1
RAGS D ADULT LEAD WORKSHEET
Site Name: Ft. Devens, Grove Pond
Receptor: Adult Non-Resident Recreational, Exposure to Sediment

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	227	mg/kg	Arithmetic mean	400	mg/kg	Recommended Soil Screening Level for Residential receptor

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	Adult Lead Model dated 5/19/03
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	NA
Where are the input values located in the risk assessment report?	Input values are located in RAGS D Table 3 for EPC and RAGS D Table 4s for exposure factors
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic Mean. Data are Located in this Appendix
What was the point of exposure and location?	Grove Pond- Near-Shore Sediment
Where are the output values located in the risk assessment report?	Located in this Appendix
What GSD value was used? If this is outside the recommended range of 1.8-2.1), provide rationale in Appendix <Y>.	GSD = 2.3 which is the currently recommended GSD for heterogeneous populations
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>	PbB0 = 1.7, This is the current model default
Was the default exposure frequency (EF; 219 days/year) used?	No, EF = 65 days/year but note that AT = 152 days. Guidance on intermittent exposure to lead states that exposure should not be annualized. Therefore exposure for the 5 month exposure period of May to September (equal to 152 days) was used as the AT.
Was the default BKSF used (0.4 ug/dL per ug/day) used?	Yes
Was the default absorption fraction (AF; 0.12) used?	Yes
Was the default soil ingestion rate (IR; 50 mg/day) used?	No. The default value for the residential adult was used equal to 100 mg/day. See RAGS D Table 4s
If non-default values were used for any of the parameters listed above, where are the rationale for the values located in the risk assessment report?	See RAGS D Table 4s

3. Final Result

Medium	Result	Comment/RBRG [1]
Soil	Input value of 227 ppm in sediment results in 2.5% of receptors above a blood lead level of 10 ug/d and geometric mean blood lead = 2.2 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	No RBRG was required because risks were not found to be higher than the action level.

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-1 BACKUP
GROVE POND
SEDIMENT

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PbB Equation[1]		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi – Hom	GSDi – Het	GSDi – Hom	GSDi – Het
PbS	X	X	Soil lead concentration	ug/g or ppm		227		
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--		0.9		
$BKSF$	X	X	Biokinetic Slope Factor	ug/dL per ug/day		0.4		
GSD_i	X	X	Geometric standard deviation PbB	--		2.3		
PbB_0	X	X	Baseline PbB	ug/dL		1.7		
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day		0.100		
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day		--		
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--		--		
K_{SD}		X	Mass fraction of soil in dust	--		--		
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--		0.12		
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr		65		
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr		152		
PbB_{adult}			**PbB of adult worker, geometric mean**	ug/dL		2.2		
$PbB_{fetal,0.95}$			**95th percentile PbB among fetuses of adult workers**	ug/dL		7.7		
PbB_t			Target PbB level of concern (e.g., 10 ug/dL)	ug/dL		10.0		
$P(PbB_{fetal} > PbB_t)$			Probability that fetal PbB > PbB_t, assuming lognormal distribution	%		2.5%		

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

*Equation 1, based on Eq. 1, 2 in USEPA (1996).

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_{S,D}/AT_{S,D}) + PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

**Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

TABLE D-2
RAGS D ADULT LEAD WORKSHEET
Site Name: Ft. Devens, Plow Shop Pond
Receptor: Adult Non-Resident Recreational, Exposure to Sediment

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	124	mg/kg	Arithmetic mean	400	mg/kg	Recommended Soil Screening Level for Residential receptor

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	Adult Lead Model dated 5/19/03
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	NA
Where are the input values located in the risk assessment report?	Input values are located in RAGS D Table 3 for EPC and RAGS D Table 4s for exposure factors
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic Mean. Data are Located in This Appendix
What was the point of exposure and location?	Grove Pond- Near-Shore Sediment
Where are the output values located in the risk assessment report?	Located in this Appendix
What GSD value was used? If this is outside the recommended range of 1.8-2.1), provide rationale in Appendix <Y>.	GSD = 2.3 which is the currently recommended GSD for heterogeneous populations
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>	PbB0 = 1.7, This is the current model default
Was the default exposure frequency (EF; 219 days/year) used?	No, EF = 65 days/year but note that AT = 152 days. Guidance on intermittent exposure to lead states that exposure should not be annualized. Therefore exposure for the 5 month exposure period of May to September (equal to 152 days) was used as the AT.
Was the default BKSF used (0.4 ug/dL per ug/day) used?	Yes
Was the default absorption fraction (AF; 0.12) used?	Yes
Was the default soil ingestion rate (IR; 50 mg/day) used?	No. The default value for the residential adult was used equal to 100 mg/day. See RAGS D Table 4s
If non-default values were used for any of the parameters listed above, where are the rationale for the values located in the risk assessment report?	See RAGS D Table 4s

3. Final Result

Medium	Result	Comment/RBRG [1]
Sediment	Input value of 124 ppm in sediment results in 1.8% of receptors above a blood lead level of 10 ug/d and geometric mean blood lead = 2.0 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	No RBRG was required because risks were not found to be higher than the action level.

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-2 BACKUP
PLOW SHOP POND
SEDIMENT

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PbB Equation[1] 1*	PbB Equation[1] 2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1, GSD_i = Hom	Using Equation 1, GSD_i = Het	Using Equation 2, GSD_i = Hom	Using Equation 2, GSD_i = Het
PbS	X	X	Soil lead concentration	ug/g or ppm		124		
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--		0.9		
$BKSF$	X	X	Biokinetic Slope Factor	ug/dL per ug/day		0.4		
GSD_i	X	X	Geometric standard deviation PbB	--		2.3		
PbB_0	X	X	Baseline PbB	ug/dL		1.7		
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day		0.100		
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day		--		
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--		--		
K_{SD}		X	Mass fraction of soil in dust	--		--		
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--		0.12		
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr		65		
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr		152		
PbB_{adult}			PbB of adult worker, geometric mean	ug/dL		2.0		
$PbB_{fetal,0.95}$			95th percentile PbB among fetuses of adult workers	ug/dL		6.9		
PbB_t			Target PbB level of concern (e.g., 10 ug/dL)	ug/dL		10.0		
$P(PbB_{fetal} > PbB_t)$			Probability that fetal PbB > PbB_t, assuming lognormal distribution	%		1.8%		

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

*Equation 1, based on Eq. 1, 2 in USEPA (1996).

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_{S,D}/AT_{S,D}) + PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

**Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

TABLE D-3
RAGS D IEUBK LEAD WORKSHEET
Site Name: Ft. Devens, Grove Pond
Receptor: Recreational Child Exposure to Sediment, Surface Water and Fish

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Sediment	227	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Water	used drinking water default	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	Model Version: 1.0 Build 261
Where are the input values located in the risk assessment report?	EPCs are in RAGS D Table 3s, Exposure Factors are in RAGS D Table 4s
What range of media concentrations were used for the model?	Sediment- used arithmetic mean Surface water- EPC was less than default for drinking water so used default value Fish Tissue- used arithmetic mean of fillet data from Grove Pond fish
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic mean. EPC data are in RAGS D Table 3s
Was soil sample taken from top 2 cm? If not, why?	Not Applicable
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	Not Applicable
What was the point of exposure/location?	Grove Pond
Where are the output values located in the risk assessment report?	Located in Appendix __
Was the model run using default values only?	No. Site specific EPCs were used for sediment. Fish tissue was included by assuming that 41 out of 273 meat meals or 15% of meat meals consisted of Grove Pond fish. This was derived from assuming that recreational child consume one meal of Grove Pond caught fish per week for 9 temperate months of the year (39 weeks).
Was the default soil bioavailability used?	Yes. Default is 30%
Was the default soil ingestion rate used?	Yes. Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in this table and RAGS Table 4s

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

3. Final Result

Medium	Result	Comment/PRG [1]
Grove Pond Sediment, Surface water, and fish	Input values from sediment, surface water and fish resulted in 2.822% of child recreational receptors above a blood lead level of 10 ug/dL. Geometric mean blood lead = 4.080 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	No PRG has been developed for this site.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-3 BACKUP
Grove Pond
LEAD MODEL FOR WINDOWS Version 1.0

==

Model Version: 1.0 Build 261
User Name:
Date: September 2005
Site Name: Grove Pond/Plow Shop Pond
Operable Unit: Grove Pond
Run Mode: Research- Recreational child

==

The time step used in this model run: 1 - Every 4 Hours (6 times a day).

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	6.729
1-2	8.446
2-3	9.542
3-4	9.487
4-5	9.442
5-6	9.954
6-7	10.933

Alternative Dietary Values

Home grown fruits concentration: 0.000 ug/g
Home grown vegetables concentration: 0.000 ug/g
Fish from fishing concentration: 0.200 ug/g
Game animals from hunting concentration: 0.000 ug/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 15.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 168.900 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	227.000	168.900
1-2	227.000	168.900
2-3	227.000	168.900
3-4	227.000	168.900
4-5	227.000	168.900
5-6	227.000	168.900
6-7	227.000	168.900

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

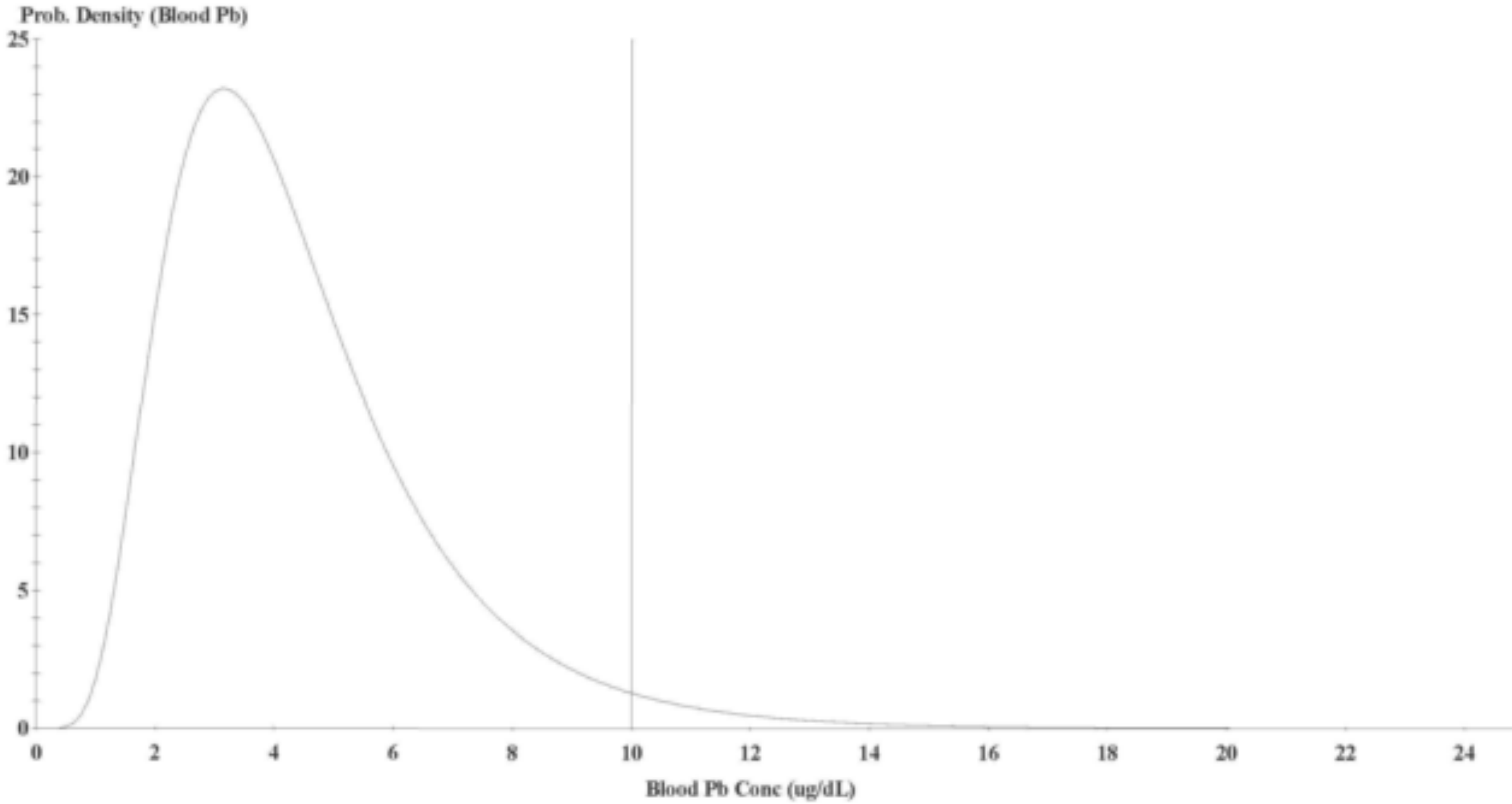
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	3.071	0.000	0.365
1-2	0.034	3.804	0.000	0.901
2-3	0.062	4.345	0.000	0.947
3-4	0.067	4.376	0.000	0.978
4-5	0.067	4.444	0.000	1.036
5-6	0.093	4.722	0.000	1.100
6-7	0.093	5.203	0.000	1.123

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	4.539	7.996	4.3
1-2	7.115	11.855	4.9
2-3	7.193	12.547	4.6
3-4	7.286	12.706	4.4
4-5	5.508	11.055	3.8
5-6	4.996	10.912	3.4
6-7	4.734	11.153	3.2



Cutoff = 10.000 ug/dl
Geo Mean = 4.080
GSD = 1.600
% Above = 2.822
% Below = 97.178

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Grove Pond- Rec Child

TABLE D-4
RAGS D IEUBK LEAD WORKSHEET
Site Name: Ft. Devens, Grove Pond
Receptor: Subsistence Child Exposure to Sediment, Surface Water and Fish

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Sediment	227	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Water	used drinking water default	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	Model Version: 1.0 Build 261
Where are the input values located in the risk assessment report?	EPCs are in RAGS D Table 3s, Exposure Factors are in RAGS D Table 4s
What range of media concentrations were used for the model?	Sediment- used arithmetic mean Surface water- EPC was less than default for drinking water so used default value Fish Tissue- used arithmetic mean of fillet data from Grove Pond fish
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic mean. EPC data are in RAGS D Table 3s
Was soil sample taken from top 2 cm? If not, why?	Not Applicable
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	Not Applicable
What was the point of exposure/location?	Grove Pond
Where are the output values located in the risk assessment report?	Located in Appendix __
Was the model run using default values only?	No. Site specific EPCs were used for sediment. Fish tissue was included by assuming that 273 out of 273 meat meals or 100% of meat meals consisted of Grove Pond fish. This was derived from assuming that the subsistence child angler consumes seven meals of Grove Pond caught fish per week for 9 temperate months of the year (39 weeks).
Was the default soil bioavailability used?	Yes. Default is 30%
Was the default soil ingestion rate used?	Yes. Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in this table and RAGS Table 4s

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

3. Final Result

Medium	Result	Comment/PRG [1]
Grove Pond Sediment, Surface water, and fish	Input values from sediment, surface water and fish resulted in 14.973% of child subsistence angler receptors above a blood lead level of 10 ug/dL. Geometric mean blood lead = 6.141 ug/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	No PRG has been developed for this site. This analysis was performed for EPA for informational purposes only.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-4 BACKUP
Grove Pond
LEAD MODEL FOR WINDOWS Version 1.0

==

Model Version: 1.0 Build 261
User Name:
Date: September 2005
Site Name: Grove Pond/Plow Shop Pond
Operable Unit: Grove Pond
Run Mode: Research- Subsistence angler child

==

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	11.560
1-2	22.781
2-3	25.122
3-4	26.014
4-5	26.915
5-6	28.129
6-7	30.509

Alternative Dietary Values
Home grown fruits concentration: 0.000 ug/g
Home grown vegetables concentration: 0.000 ug/g

Fish from fishing concentration: 0.200 ug/g
Game animals from hunting concentration: 0.000 ug/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 100.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 168.900 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	227.000	168.900
1-2	227.000	168.900
2-3	227.000	168.900
3-4	227.000	168.900
4-5	227.000	168.900
5-6	227.000	168.900
6-7	227.000	168.900

****** Alternate Intake ******

Age Alternate (ug Pb/day)

.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

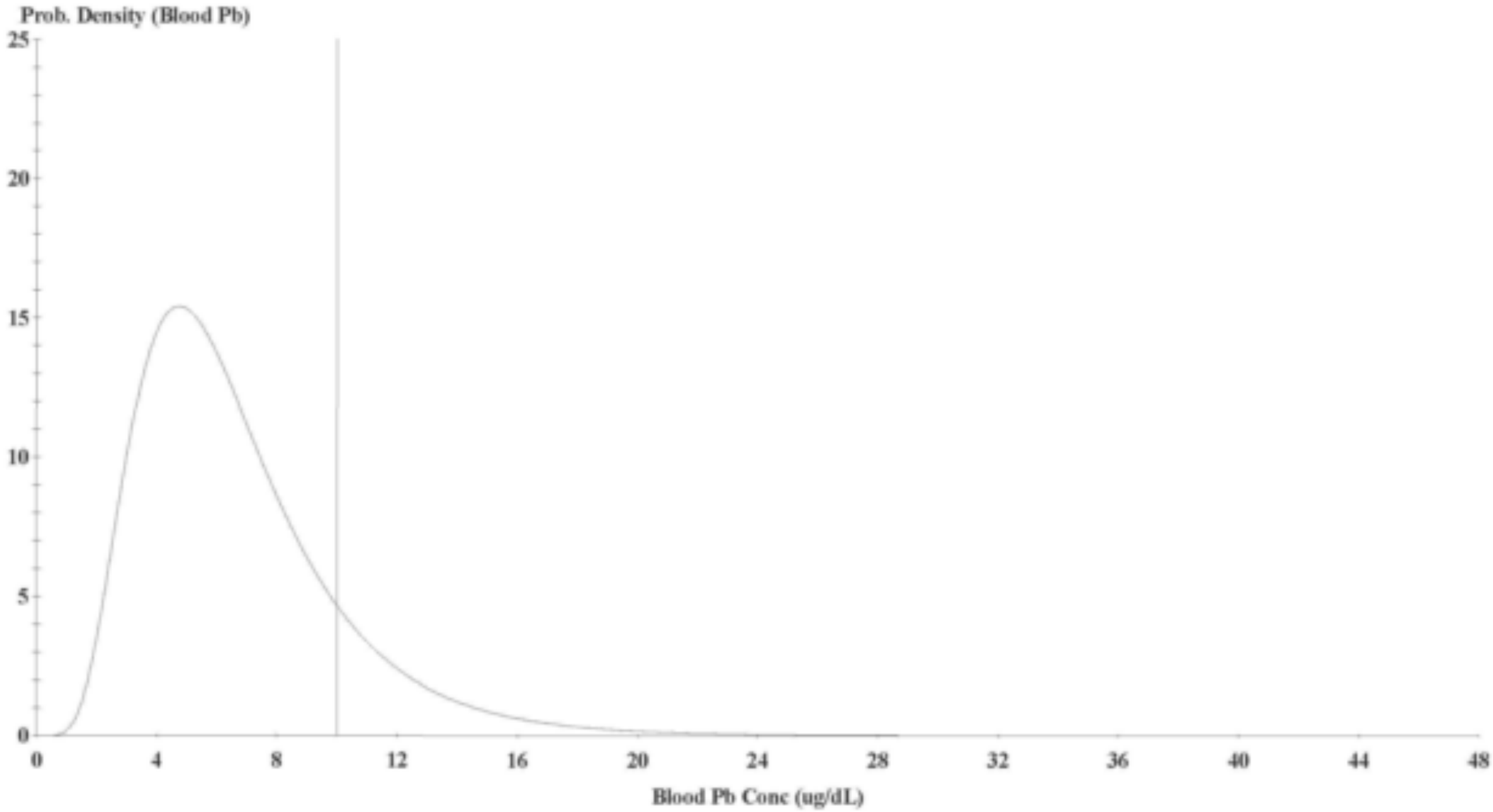
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	5.155	0.000	0.357
1-2	0.034	9.754	0.000	0.856
2-3	0.062	10.905	0.000	0.903
3-4	0.067	11.478	0.000	0.935
4-5	0.067	12.151	0.000	0.993
5-6	0.093	12.831	0.000	1.058
6-7	0.093	13.966	0.000	1.080

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	4.436	9.968	5.4
1-2	6.764	17.409	7.0
2-3	6.858	18.729	6.9
3-4	6.971	19.451	6.7
4-5	5.283	18.493	6.2
5-6	4.804	18.787	5.8
6-7	4.553	19.693	5.5



Cutoff = 10.000 ug/dl
Geo Mean = 6.141
GSD = 1.600
% Above = 14.973
% Below = 85.027

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Grove Pond-Subsist ChildAngler

TABLE D-5
RAGS D IEUBK LEAD WORKSHEET
Site Name: Ft. Devens, Plow Shop Pond
Receptor:Recreational Child Exposure to Sediment and Surface Water

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Sediment	used model default	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Surface Water	used model default	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	Model Version: 1.0 Build 261
Where are the input values located in the risk assessment report?	EPCs are in RAGS D Table 3s, Exposure Factors are in RAGS D Table 4s
What range of media concentrations were used for the model?	Sediment- EPC was less than the default for soil expousre Surface water- EPC was less than default for drinking water so used default value Fish- lead in fish tissue was not a COPC for Plow Shop Pond fish
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Not Applicable
Was soil sample taken from top 2 cm? If not, why?	Not Applicable
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	Not Applicable
What was the point of exposure/location?	Plow Shop Pond
Where are the output values located in the risk assessment report?	Located in Appendix __
Was the model run using default values only?	Yes
Was the default soil bioavailability used?	Yes Default is 30%
Was the default soil ingestion rate used?	Yes Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in this table and RAGS Table 4s

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

3. Final Result

Medium	Result	Comment/PRG [1]
Plow Shop Pond Sediment, Surface water,	Input values from sediment, and surface water resulted in 1.101% of recreational children above a blood lead level of 10 ug/dL. Geometric mean blood lead = 3.409 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	No PRGs have been developed for this site.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-5 BACKUP
Plow Shop Pond
LEAD MODEL FOR WINDOWS Version 1.0

==

Model Version: 1.0 Build 261
User Name:
Date: September 2005
Site Name: Grove Pond/Plow Shop Pond
Operable Unit: Plow Shop Pond
Run Mode: Research- Recreational Child

==

The time step used in this model run: 1 - Every 4 Hours (6 times a day).

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	5.530
1-2	5.780
2-3	6.490
3-4	6.240
4-5	6.010
5-6	6.340
6-7	7.000

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	200.000	150.000
1-2	200.000	150.000
2-3	200.000	150.000
3-4	200.000	150.000
4-5	200.000	150.000
5-6	200.000	150.000
6-7	200.000	150.000

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

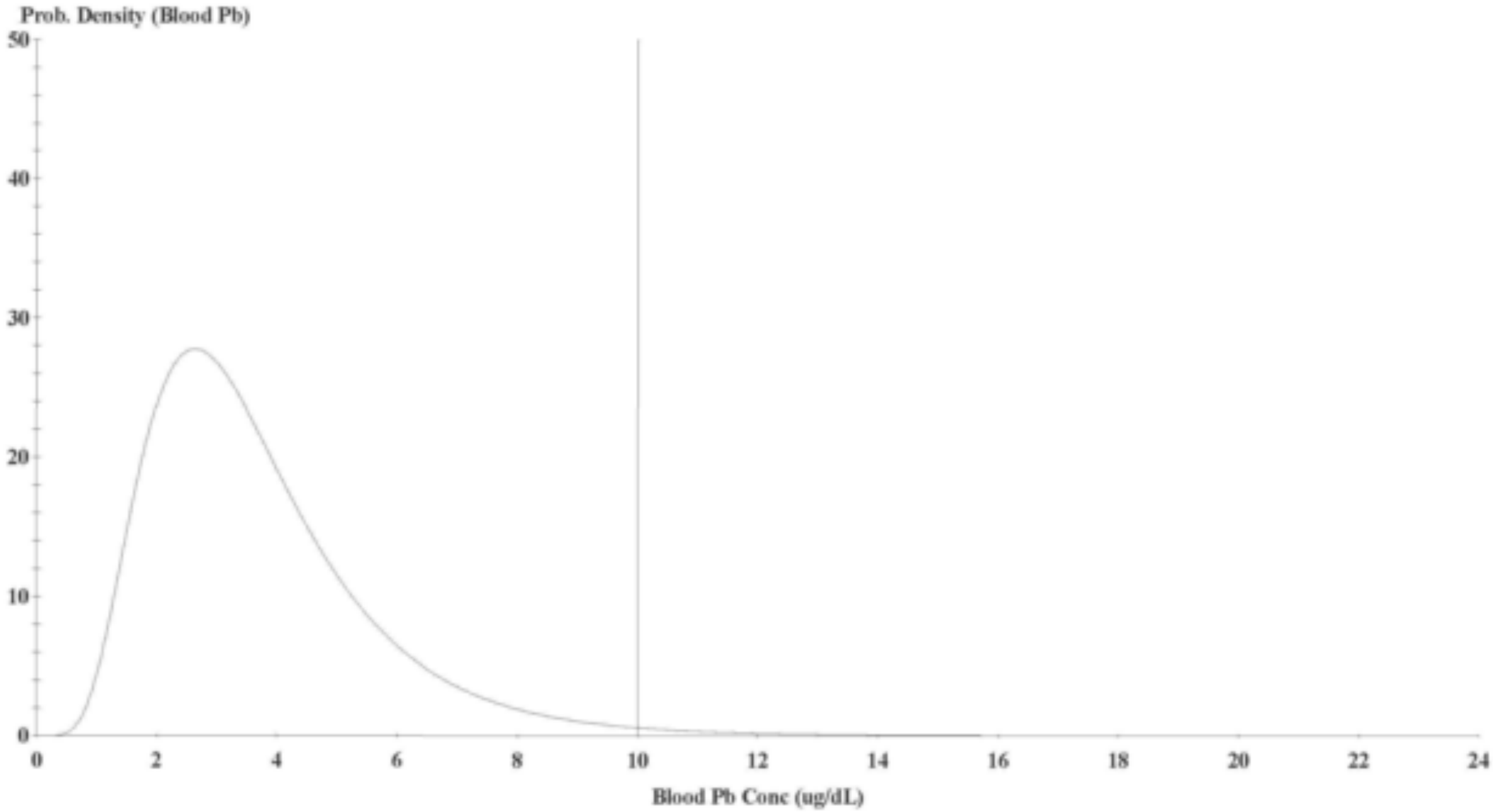
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	2.553	0.000	0.369
1-2	0.034	2.647	0.000	0.916
2-3	0.062	3.002	0.000	0.962
3-4	0.067	2.919	0.000	0.992
4-5	0.067	2.863	0.000	1.048
5-6	0.093	3.040	0.000	1.112
6-7	0.093	3.366	0.000	1.135

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	4.061	7.004	3.8
1-2	6.399	9.997	4.2
2-3	6.462	10.488	3.9
3-4	6.536	10.514	3.7
4-5	4.930	8.908	3.1
5-6	4.467	8.712	2.7
6-7	4.231	8.826	2.5



Cutoff = 10.000 ug/dl
Geo Mean = 3.409
GSD = 1.600
% Above = 1.101
% Below = 98.899

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Plow Shop Pond- Rec Child

Fish from fishing concentration: 0.200 ug/g
Game animals from hunting concentration: 0.000 ug/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 100.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 168.900 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	227.000	168.900
1-2	227.000	168.900
2-3	227.000	168.900
3-4	227.000	168.900
4-5	227.000	168.900
5-6	227.000	168.900
6-7	227.000	168.900

****** Alternate Intake ******

Age	Alternate (ug Pb/day)

.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

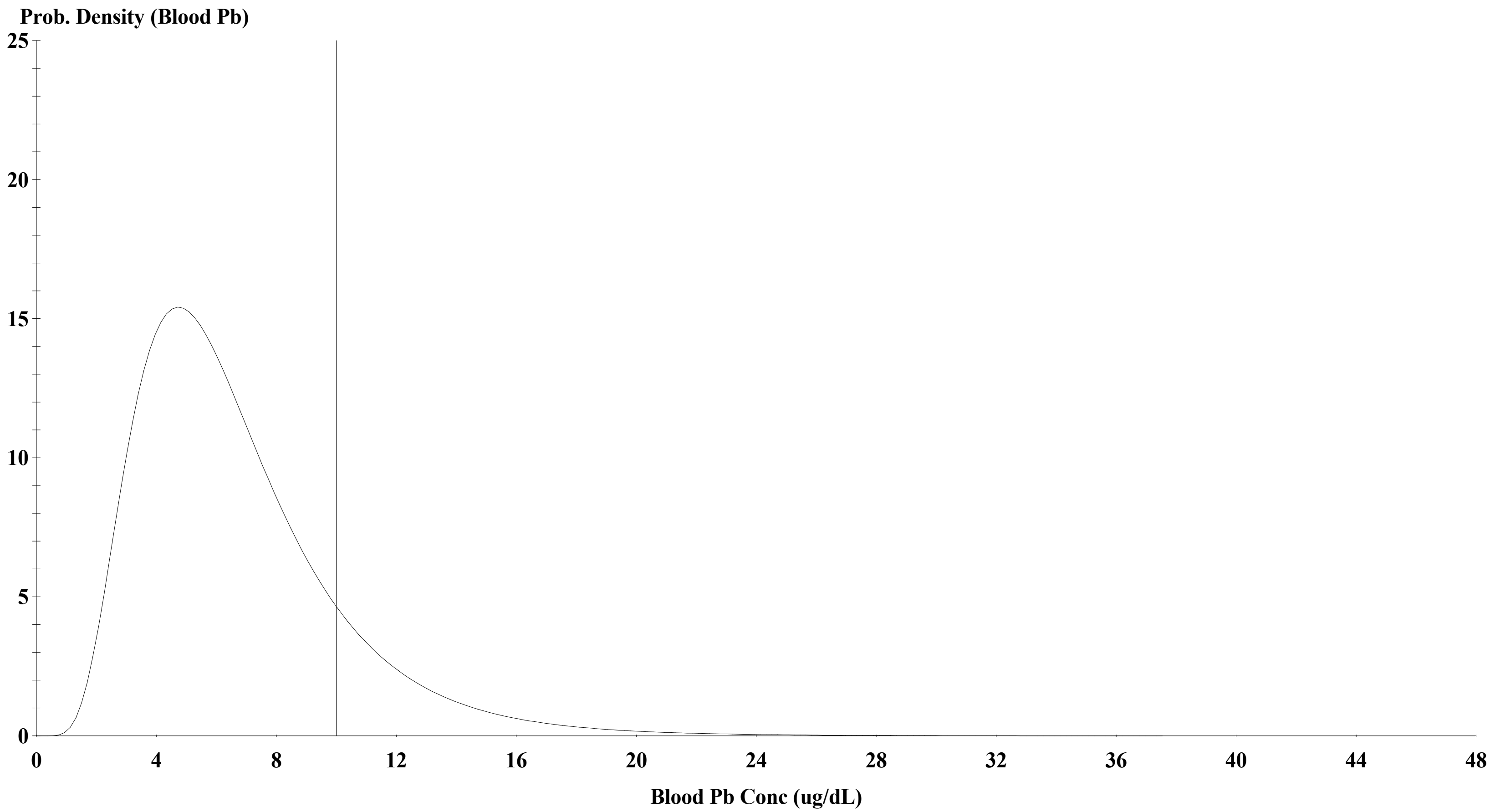
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	5.155	0.000	0.357
1-2	0.034	9.754	0.000	0.856
2-3	0.062	10.905	0.000	0.903
3-4	0.067	11.478	0.000	0.935
4-5	0.067	12.151	0.000	0.993
5-6	0.093	12.831	0.000	1.058
6-7	0.093	13.966	0.000	1.080

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	4.436	9.968	5.4
1-2	6.764	17.409	7.0
2-3	6.858	18.729	6.9
3-4	6.971	19.451	6.7
4-5	5.283	18.493	6.2
5-6	4.804	18.787	5.8
6-7	4.553	19.693	5.5



Cutoff = 10.000 ug/dl
Geo Mean = 6.141
GSD = 1.600
% Above = 14.973
% Below = 85.027

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Grove Pond-Subsist ChildAngler

TABLE D-5
RAGS D IEUBK LEAD WORKSHEET
Site Name: Ft. Devens, Plow Shop Pond
Receptor:Recreational Child Exposure to Sediment and Surface Water

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Sediment	used model default	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Surface Water	used model default	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	Model Version: 1.0 Build 261
Where are the input values located in the risk assessment report?	EPCs are in RAGS D Table 3s, Exposure Factors are in RAGS D Table 4s
What range of media concentrations were used for the model?	Sediment- EPC was less than the default for soil expousre Surface water- EPC was less than default for drinking water so used default value Fish- lead in fish tissue was not a COPC for Plow Shop Pond fish
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Not Applicable
Was soil sample taken from top 2 cm? If not, why?	Not Applicable
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	Not Applicable
What was the point of exposure/location?	Plow Shop Pond
Where are the output values located in the risk assessment report?	Located in Appendix __
Was the model run using default values only?	Yes
Was the default soil bioavailability used?	Yes Default is 30%
Was the default soil ingestion rate used?	Yes Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in this table and RAGS Table 4s

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

3. Final Result

Medium	Result	Comment/PRG [1]
Plow Shop Pond Sediment, Surface water,	Input values from sediment, and surface water resulted in 1.101% of recreational children above a blood lead level of 10 ug/dL. Geometric mean blood lead = 3.409 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	No PRGs have been developed for this site.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-5 BACKUP
Plow Shop Pond
LEAD MODEL FOR WINDOWS Version 1.0

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Model Version: 1.0 Build 261
User Name:
Date: September 2005
Site Name: Grove Pond/Plow Shop Pond
Operable Unit: Plow Shop Pond
Run Mode: Research- Recreational Child

==

The time step used in this model run: 1 - Every 4 Hours (6 times a day).

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	5.530
1-2	5.780
2-3	6.490
3-4	6.240
4-5	6.010
5-6	6.340
6-7	7.000

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	200.000	150.000
1-2	200.000	150.000
2-3	200.000	150.000
3-4	200.000	150.000
4-5	200.000	150.000
5-6	200.000	150.000
6-7	200.000	150.000

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
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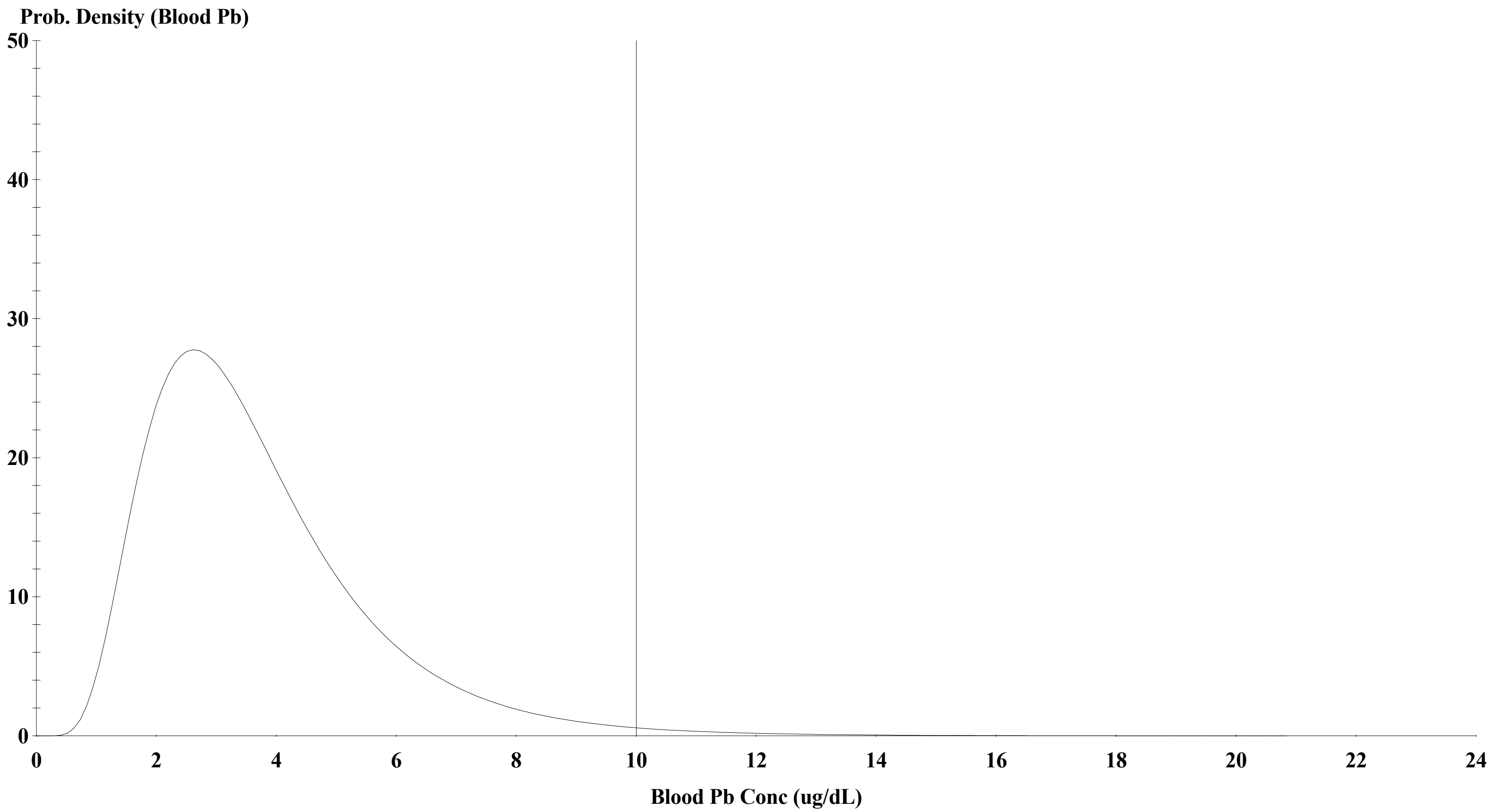

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Geo Mean = 3.409
GSD = 1.600
% Above = 1.101
% Below = 98.899

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Plow Shop Pond- Rec Child